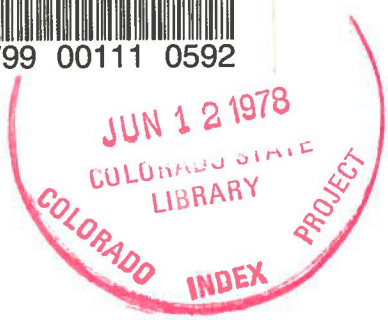

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AFDC, FOOD STAMP, AND PUBLIC HOUSING TAXES IN SEATTLE AND DENVER IN 1970-71

By: Harlan I. Halsey

STANFORD RESEARCH INSTITUTE
Menlo Park, California 94025 · U.S.A.

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By: HARLAN I. HALSEY

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Project Leader: Robert G. Spiegelman

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CONTENTS

ACKNOWLEDGMENTS iii

LIST OF ILLUSTRATIONS vii

LIST OF TABLES ix

SUMMARY AND CONCLUSIONS xi

I INTRODUCTION 1

Income Taxes on Public Assistance 1
Household Structure 4
Deviation from the Statutory Functions 5

II THEORY 9

The Budget Constraint for Families on Public Assistance . . 9
The Total Marginal Tax Rate 10
AFDC, Food Stamp, and Public Housing Implicit Tax Functions 11
Income Underreporting 12
Reduced Form Tax Functions 12
A Partially Reduced Form 13
Fully Reduced Form 14
Estimation of Effective Public Assistance Tax Functions . . 14
Data Sources 16
Analysis Files 17

III THE AFDC PROGRAM 19

Introduction 19
Statutory AFDC Tax Function 20
Reduced Form AFDC Tax Function 22
Econometric Specification 26
Empirical Findings 30
Family Structure and the Support Level 30
Work-Related Expenses in Seattle 33
Reduced Form Effective AFDC Tax Functions 34
Conclusions 41

IV THE FOOD STAMP PROGRAM 47

Introduction 47
Statutory Food Stamp Tax Function 48
Reduced-Form Tax Function for AFDC Participants 53
Econometric Specification 54
Empirical Findings 56

V PUBLIC HOUSING PROGRAMS 61
Introduction 61
Statutory Public Housing Tax Function 64
Reduced Form Tax Function for Non-Public Assistance Families 65
Reduced Form Tax Function for AFDC and Food Stamps Families 66
Regression Equation 67
Empirical Findings 69
Conclusions 71

ILLUSTRATIONS

1	The Budget Constraint Under Public Assistance	3
2	A Schematic View of the Food Stamps Benefit Function	50
3	Public Housing Tax Function	64

TABLES

1	Effective Total Marginal Tax Rate for Family Members Participating in the AFDC Program	xii
2	Reduced-Form Marginal Tax Rates for AFDC and Non-AFDC Participant Families in 1971	xiii
3	Total Marginal Tax Rates for Female and Male Heads of Families Living in Public Housing	xvi
4	Tax Rates for Federal, State, and Social Security Withholding	23
5	Total Positive Tax Withholding Rates for Family of Four in Denver	24
6	Total Positive Tax Withholding Rates for a Family of Four in Seattle	24
7	Support Level Regressions	31
8	AFDC Work-Related Expenses Regression	35
9	AFDC Tax Regressions - Taxable Income - Linear	37
10	AFDC Tax Regressions - Taxable Income - Declining Rate	38
11	AFDC Regressions All Income - Linear	42
12	AFDC Regressions All Income - Declining Rate	43
13	Total Marginal Tax Rate for Female Heads Participating in the AFDC Program	45
14	Monthly Coupon Allotment and Purchase Requirement	49
15	Reduced-Form Marginal Tax Rates for Non-AFDC Participant Families in 1971	53
16	Reduced-Form Marginal Tax Rates for AFDC Participant Families in 1971	54
17	Food Stamps Regressions	57
18	Sample Sizes and Proportions of the Public Housing Sample on AFDC and Food Stamps	68
19	Public Housing Rent Regressions	70
20	Total Marginal Tax Rates for Female Heads of Public Housing Families	72

SUMMARY AND CONCLUSIONS

Introduction

Many public transfer programs incorporate a schedule of benefits that decline with increasing income. These income-determined reductions are implicit income taxes. The implicit income tax rates are high so as to limit the income transfer to the lowest income segment of the nation. Such high tax rates have a pronounced effect on work incentives on the one hand and on incentives to report income to the transfer agencies on the other. Income underreporting affects the effective tax rates imposed by transfer agencies, and thus affects the work incentives. The subject of this report is the determination of the effective implicit income tax rates of the AFDC, Food Stamps, and Public Housing programs, taking income underreporting and administrative error and bias into account. This effort took place within the context of the SIME/DIME income maintenance experiments, because knowledge of the effective incentive structure faced by the control group is necessary to assess the differential effects of the various negative income tax treatments. Any proposal for welfare reform, however, should begin from a knowledge of the effective contemporary welfare system, since it is quite different from that specified by statute.

Methodology

The direct relationship between the benefit reduction and income as described by statute is called the structural tax function. The transfer program structural marginal tax rate is irrelevant for the economic analysis labor supply, however, because the transfer programs benefit reductions are interdependent, because of administrative bias and because income underreporting alters the effective tax rates. The structural marginal tax rates cannot, therefore, be summed to a total marginal tax rate relevant to the work incentive.

Interdependence arises because welfare programs reimburse positive tax withholding and tax the benefits of other programs. For example, AFDC reimburses the Federal Personal Income Tax, and the Food Stamp Program counts the AFDC grant in taxable income. Interdependence is handled systematically by solving the set of structural tax functions for a system of reduced form equations in which there are no interactions. In the statutory reduced form system, individual program taxes are functions of income, deductions from income, and family structure, but not of the benefits or taxes of other programs. Were it not for administrative bias or income underreporting, the marginal tax rates of the reduced form tax functions could be summed to the relevant total marginal tax rate.

The effect of income underreporting is handled by augmenting either system of tax functions with a set of income reporting functions specifying income underreporting. Effective implicit income tax functions can be derived either by solving the augmented system for effective reduced form tax functions and empirically estimating their parameters, or by estimating the statutory reduced forms and the income reporting functions separately and then solving the augmented system of empirical equations for the effective implicit tax functions. The latter method has the advantage of differentiating between administrative bias and income underreporting, where the former method confounds the two different effects. In this report, we follow the former route because we lack the administrative data for the Food Stamp and Public Housing Programs. Structural form estimates were made for the AFDC program. These indicated a complete lack of administrative bias in our sample.

The AFDC Program

In the empirical section of this report we show that the effective AFDC marginal tax rates on earned income are far lower than the statutory reduced form marginal tax rates, and a fortiori lower than the often quoted structural form marginal tax rate of 67%. This is so because the AFDC program fails to capture much of the income that accrues to the economic family unit. There are two major reasons for this shortfall. First, the AFDC taxation unit is not defined on the assumption that all family heads and dependent children are treated equally within the family. This AFDC position, although economically unsound, is practical. It is based upon the fact that economic family units that benefit from scale economies

can be formed and dissolved rapidly, and the social cost of determining when such units exist is extremely high. The infamous "man in the house" rule of the 1960s, under which it was presumed that almost any man found in the dwelling after dark was a parent (and therefore within the AFDC taxation and/or eligibility unit), led to extreme efforts on the part of the families to disguise the true relationship between the family heads and to no less extreme efforts on the part of welfare departments to find male heads in residence. As a result, the AFDC program has retreated to a more rigid definition of the AFDC family taxation and support unit, based upon biological paternity and formal marriage and child adoption. The other cause of the shortfall in income reported to AFDC is simply that individuals clearly within the AFDC taxation unit often fail to report all their income. This is not surprising in view of the fact that the federal tax system, for example, has found it desirable to institute direct employer reporting of wages and salaries and direct bank and brokerage house reporting of interest and dividends to encourage income reporting.

The expected AFDC marginal tax rate on the earnings of the male head is approximately 5% in both Seattle and Denver. The marginal tax rate on earnings of the female head is not significantly different from zero up to $35 per month in Seattle and $81 per month in Denver. Above $35 in Seattle, the marginal tax rate appears to be a constant 25 to 27%. Above $81 in Denver, the marginal tax rate appears to be a constant 25% in 1970, and a slowly declining function of earnings, beginning at 33% and declining at the rate of 6% per hundred dollars of earnings, in 1971. At the mean values of female head earnings, $170, $190, and $191, in Seattle 1970 and 1971, Denver 1970, and Denver 1971, respectively, the marginal tax rate estimates are 26%, 21%, and 24%. The comparable statutory reduced form tax rates are above 40%. The marginal tax rate on earnings of other members of the family differs between Seattle and Denver, apparently because of the difference in the AFDC program treatments of these individuals. In Seattle, such individuals tend to be included in the taxation unit, and bear a 13% marginal tax rate on their earnings. In Denver, they tend to be excluded from the taxation unit and their

marginal tax rate is not statistically different from zero. Effective total marginal tax rates for AFDC family members are presented in Table 1; nonparticipation in other welfare programs is assumed for the positive tax rates, either individual (rather than joint) filing or zero income of other family members is assumed.

The Food Stamp Program

The Food Stamp Program was enacted in 1964 with the objective of subsidizing low-income households to enable them to purchase a nutritionally adequate diet. Food stamps are coupons with monetary value, redeemable only for a restricted category of food and not transferrable. The difference between the food stamps allotment, which is based on household size, and the purchase price constitutes the food stamp benefit. The purchase price is a function of household income, increasing as household income increases. Therefore, the purchase price constitutes an implicit tax on income. AFDC and certain general assistance recipients are categorically eligible. Other households must pass asset and income tests, although there is no formal family structure requirement.

The food stamp purchase requirement is determined by a table that relates income net of the deductions allowed, to the purchase price. The table is a step function with 10-dollar income steps below $190 and 20-dollar steps above, which we approximate with a smooth function drawn through the middle of the steps.

Exclusion of 10% of wage income up to $30 per month, reimbursement of positive taxes, and exclusion of rent in excess of 30% of net income results in statutory marginal tax rates on earnings from 22 to 33% for non-AFDC families.

AFDC families face a different reduced form food stamp tax function because their AFDC grant is taxed as nonwage income. Because the AFDC grant declines as earnings increase, a reduction occurs in the statutory marginal tax rates of 5 to 13% over the marginal tax rates faced by non-AFDC participants. The statutory reduced form marginal tax rates for Food Stamp Program participants are shown in Table 2.

Table 1

EFFECTIVE TOTAL MARGINAL TAX RATE FOR FAMILY MEMBERS PARTICIPATING IN THE AFDC PROGRAM*

	Seattle		Denver		
	Earned Income ($)	1970/71 (%)	Earned Income ($)	1970 (%)	1971 (%)
Female heads	0-35	5	0-81	5	5
	35-300	31	81-300	33	39
	300-650	48	300-650	40	39
	650-1,000	42	650-1,000	26	19
Male heads	0-35	5	0-81	5	5
	35-300	10	81-300	10	10
	300-650	27	300-650	29	29
	650-1,000	21	650-1,000	24	24
Nonheads	0-35	5	0-81	5	5
	35-300	18	81-300	5	5
	300-650	35	300-650	24	24
	650-1,000	29	650-1,000	19	19

*Positive tax rates are approximated by 5%, 22%, and 16% in the income ranges $0-$300, $300-$650, $650-$1,000 in Seattle and by 5%, 24%, and 19% in the same ranges in Denver.

Table 2

REDUCED-FORM MARGINAL TAX RATES
FOR AFDC AND NON-AFDC PARTICIPANT FAMILIES IN 1971

	Earned Income ($)	Seattle Rent Deduction 0 (%)	Seattle Rent Deduction >0 (%)	Denver Rent Deduction 0 (%)	Denver Rent Deduction >0 (%)
Non-AFDC	100	25	33	25	33
	350	24	22	24	21
	650	25	23	24	22
AFDC	100	14	21	13	20
	350	13	18	12	16
	650	14	19	12	17

Effective food stamp tax functions were estimated over the sample with positive food stamp taxable SIME/DIME income. The coefficients of the earnings of the male and female heads are all less than 3% and all of the wrong sign. Surprisingly, some of these coefficients are significantly different from zero. Most of the nonwage income coefficients are very small, with alimony received by non-AFDC households, a puzzling exception. The coefficient of the number of household members, however, is surprisingly large, statistically significant, and may hold the key to understanding the reason behind the generally unsatisfactory results of these regressions.

What may have happened in part is that either the family or the interviewer confused face value (or allotment) with the purchase requirement (or cost). Unfortunately, the questionnaire asked for the face value and cost rather than the Food Stamp Program terms of allotment and purchase requirement. To the extent that this reversal happened, we would expect to see more family size dependence in the "cost of food stamps" variable, and less taxation effect. As a quick check, the Denver 1970 tax functions were reestimated under the constraint that the yearly average face value of food stamps purchased exceeds the average cost. Because this constraint resulted in a slight alteration

of the estimates, we can conclude that the recorded cost exceeds the recorded face value for an entire year in some cases, which is an impossibility. Furthermore, in the 1973 Validation Study, the food stamps benefit reported to SIME/DIME was the only nonwage income component for which the amount reported to SIME/DIME exceeded the amount recorded in the Food Stamps Program records. These factors indicate that a thorough check of the SIME/DIME Food Stamps Program data is needed.

Unfortunately we do not have sufficient confidence in the food stamp data collected on the Seattle and Denver Income Maintenance experiments' interviews to warrant a conclusion regarding the true tax rate on food stamps at this time. The implication of a near zero marginal tax rate on income in the Food Stamps Program has serious implications and needs more verification with use of data collected directly from the welfare agency.

The Public Housing Programs

Public housing programs have the objective of providing decent, safe, sanitary, low-rent housing and related facilities for low-income families. Housing programs either enable apartments to be constructed at low cost to the owner through various subsidies or they subsidize the rent directly.

Tenant rent payments in subsidized housing are usually 20 to 25% of adjusted family income. Income adjustments vary from program to program, however, as in other income-dependent transfer programs. The rent paid is an implicit tax on income. The public housing benefit is the difference between the market rental value of the apartment and the rent paid.

Eligibility for publicly supported housing depends upon family structure, assets, and income. Income limits are set by the Seattle Housing Authority and the Denver Housing Authority, which require that income be between minimum and maximum values dependent on family size. The minimum income functions effectively to keep the very poor out of SHA and DHA housing, but the upper limit is less effective because

families once living in subsidized housing are rarely if ever required to leave because of an increase in income.

The public housing rent tax functions continue the pattern found in the AFDC empirical tax function of low but statistically significant marginal tax rates on earnings and large variances on nonwage income coefficients. The 5% marginal tax rate on earned income is about one-fourth the statutory value of 19% for non-AFDC, nonfood stamps families, but is not far from the statutory rate for AFDC families. This situation is not surprising, as privacy laws prevent public housing authorities from direct contact with employers, and landlords have little incentive to raise family rents as additional rent goes to the government, not to the landlord. Public housing authorities have commented in telephone conversations that they feel they are the last to know when family income changes, that they learn of changes even after the AFDC program learns of them. Effective total marginal tax rates for AFDC and non-AFDC participating public housing families are shown in Table 20. In Table 3 either nonparticipation in the Food Stamp Program or an effective Food Stamp Program zero marginal tax rate is assumed. For the positive tax rates, either zero income of other family members or individual (rather than joint) filing is assumed.

Potential Sources of Bias in the Estimates

There are three immediate potential sources of bias in our estimates, simultaneity, errors in variables, and truncation of the sample. These three sources are discussed below.

Most equations and systems of equations can be regarded as subunits of a larger system. The system of tax equations discussed here is part of a larger system in which labor supply is determined. In such a system, earnings are an endogenous variable, and our reduced form equations are structural equations. In this situation, our empirical tax functions are subject to simultaneous equations bias. Simultaneous equations bias occurs because the expectation of the product of the earnings variable with the error term is not zero when earnings are no longer exogenous and are correlated with the error term of the empirical function.

Table 3

TOTAL MARGINAL TAX RATES FOR FEMALE AND MALE HEADS OF FAMILIES LIVING IN PUBLIC HOUSING

	Seattle		Denver		
	Earned Income ($)	1970/71 (%)	Earned Income ($)	1970 (%)	1971 (%)
Non-AFDC female heads	0-300	9		8	12
	300-650	26		27	31
	650-1,000	20		22	26
AFDC Participant female heads	0-35	10	0-81	9	18
	35-300	36	81-300	34	66
	300-650	55	300-650	53	56
	650-1,000	50	650-1,000	48	34
Non-AFDC male heads*	0-300	11		10	10
	300-650	28		27	27
	650-1,000	22		21	21
AFDC participant male heads*	0-35	7	0-81	9	15
	35-300	33	81-300	39	63
	300-650	52	300-650	58	49
	650-1,000	47	650-1,000	48	31

*Positive tax rates are approximated by 5%, 22%, and 16% in the income ranges 0-300, 300-650, 650-1,000 in Seattle and by 5%, 24%, and 19% in the same ranges in Denver.

Families receiving unusually large public transfers will tend to earn less. As a result, the impact of high nonwage income, of which public transfers are a component, upon earnings is negative in typical labor-supply equations. Although we estimated tax functions, the procedure is equivalent to estimating grant functions in which the support level coefficient is restricted to one. In the grant function, the coefficient of the earnings variable (the marginal tax rate) is negative, as is the bias. Therefore, because of simultaneous equations bias, our estimates of the tax rate are biased negatively, e.g., an unbiased estimation procedure would measure still lower tax rates than those presented here. This effect is likely to be important only in the AFDC tax functions, as the AFDC transfer is a sizable component relative to total income, whereas the food stamps benefit, and public housing benefits are much less so. An important conclusion of this report is that the empirical tax rates are low, far lower than the law provides. Correction of simultaneous equation bias can only strengthen this conclusion.

Errors in measurement of the variables will tend to bias the estimates toward zero. Potential for error in measurement always exists, and it is particularly difficult to avoid when measuring income, which most people regard as private and upon which they have been more or less heavily taxed. A great deal of effort was directed at avoiding error in the measurement of income in SIME/DIME, although undoubtedly some error still persists. The SIME/DIME Validation Study indicates that the interview system, which is kept separate from the payments system, collects about as much earned income as does the Internal Revenue Service. Whether or not the variance in the errors more than offsets the bias because of underreporting remains moot.

Our sample is truncated because a family enters only if it receives positive benefits. As income rises toward the breakeven point, the benefit falls toward zero. Highly taxed families will leave the program because transaction costs exceed the benefit. Families with exceptionally low implicit taxes will tend to remain in the program and in our sample. This effect will bias the estimated tax rates toward zero. The seriousness of this effect is difficult to assess. However, the most severe

potential effect, that caused by families remaining in the program with income well beyond the breakeven point, does not occur in our sample.

Suggestions for Further Research

In this paper we have presented empirical estimates of the expected tax functions faced by SIME/DIME families. A limitation of this expected tax function approach is that it weights the tax rates by the probability that in our sample an individual SIME/DIME family member is in the public transfer taxation unit. The SIME/DIME sample is a non-random sample of the low-income population. Families that could be expected to exhibit small labor-supply response to a negative income tax, e.g., female-headed families in which the female head is not in the labor force, were undersampled. Therefore, our sample is weighted towards dual-headed families and female-headed families in the labor force. As a result, the probability that a SIME/DIME male head, or nonhead, is also a member of the transfer program taxation unit may not be the same as it would be in a true random sample of the low-income population. For female heads of families on the AFDC program and both heads of public housing families, the probability that they are in the taxation unit is close to one, and the expected tax rates equal the actual tax rates faced by individuals. For the male heads of AFDC families, however, the probability that a SIME/DIME male head is in the AFDC taxation unit is substantially less than one. Thus the expected tax rates appear to be very low. The wide latitude allowed in the Food Stamp Program results in the same difficulty.

An attractive alternative estimation strategy is suggested by the set of structural tax equations augmented by the income reporting equations discussed in Section II. Instead of solving the augmented set of structural equations for the reduced form tax functions, one can solve the structural tax equation subset to derive reduced-form statutory tax functions that can then be empirically determined. Empirically determined income reporting equations relating reported income to actual (SIME/DIME measured) income can then be used to solve for the effective

tax rates. If the income reporting equations are estimated over individuals known to be in the transfer program taxation unit, then tax functions conditional upon individual rather than family welfare program participation could be estimated.

I INTRODUCTION

Income Taxes on Public Assistance

The Seattle and Denver Income Maintenance Experiments (SIME/DIME) are designed to test the effects of a negative income tax on selected samples of the low-income populations of these two cities. The experimental and control samples contain significant fractions of households that participate in the normal public assistance programs, such as the Aid to Families with Dependent Children (AFDC) program, the Food Stamp Program, and the various public housing programs. These programs impose an implicit income tax on their participants through the reduction of benefits as income rises. The tax rates so imposed affect the net wage and, therefore, labor supply, one of the most important areas affected by the negative tax experiment. Therefore, an understanding of the public welfare system is important to the success of the SIME/DIME projects. This is an econometric study of the three most important public assistance programs: the AFDC program, the Food Stamp Program, and the public housing programs. Our primary objective is to determine the implicit income taxes and tax rates, summarized in the tax functions of these programs. These tax functions, along with the positive tax system tax functions, determine the total marginal tax rate which is the appropriate quantity for most economic analysis.

Implicit income taxes arise in the following way. A public assistance program provides a basic level of support to households with no other income. As income rises, the amount of the benefit is reduced from the support level by a formula specified by the congressional legislation that originally defined the program. This income-determined reduction in the benefit is, in effect, an income tax. The public assistance benefit has two aspects: the support level that can be recognized as a contribution to disposable nonwage income and the income-dependent reductions, which are the implicit income taxes. Consider the example

shown in Figure 1, which loosely follows the AFDC program. The budget constraint (the amount of disposable income available to the family) is indicated by the line S, A, B, C, D. In the income range between zero and Y_1, the family receives the support level S and faces zero taxation. From Y_1 to Y_4 the implicit public assistance tax, T_I, is assessed through reductions in the benefit. Above Y_4, the benefit is zero, and the family faces only positive taxes, T. Positive taxation (fully reimbursed by public assistance in the example) begins at Y_2. Between Y_2 and Y_3, the benefit consists partly of the public assistance grant, or negative tax, N, and partly of the reimbursement of positive taxes. Y_3 is the program breakeven level, the income level at which the grant has been reduced to zero by the implicit tax. Y_4 is the tax breakeven level. Between Y_3 and Y_4, the public assistance benefit consists entirely of positive tax reimbursement.

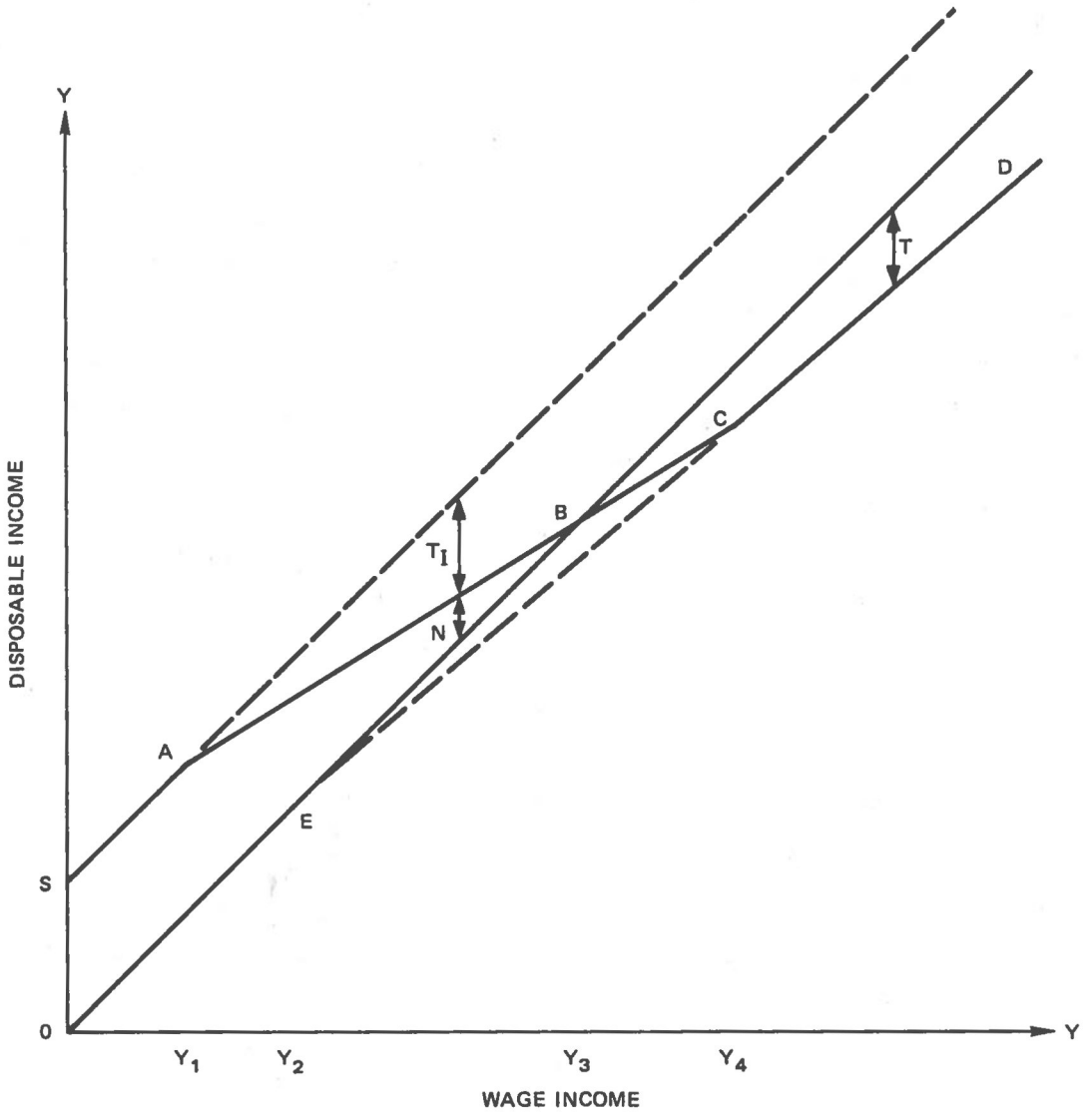
The implicit tax, T_I, acts to reduce disposable income in exactly the same way that the normal positive tax, T, does.

Utility-maximizing behavior depends on the slope of the budget constraint. The relationship between the net marginal wage, the gross wage, w, and the budget constraint is:

$$w_{net} \equiv \frac{\partial Y_d}{\partial L} = w \frac{\partial Y_d}{\partial E} = w\left(1 - \frac{\partial T_I}{\partial E} - \frac{\partial T}{\partial E}\right) \quad ,$$

where Y_d is disposable income, L is hours worked, T_I is the program implicit tax function, T is positive taxes paid, and E is wage income, wL. It is important to note that $\partial T_I/\partial E$ is the total rate of change of the implicit income tax paid, holding nonwage income constant, and where all interactions among all the public assistance and positive tax programs are taken into account. The proper handling of the interactions is extremely important. This issue is taken up in detail in Section II.

Public assistance programs are sometimes called negative tax, or transfer programs, because the net effect of participation in these programs is a transfer of income to the household rather than a transfer of income from the household, as is the case with positive tax programs



LEGEND: S = PROGRAM SUPPORT LEVEL
T_I = PROGRAM IMPLICIT TAX
N = NEGATIVE TAX
P = POSITIVE TAX

FIGURE 1 THE BUDGET CONSTRAINT UNDER PUBLIC ASSISTANCE

such as federal and state income taxes. (This is indicated by the distance N in Figure 1 where $N = S - T_I$.) Here, for the sake of uniformity, we adopt the terminology that the transfer to the household is called a grant. The relationship of the grant with its determinants, earnings, nonwage income, the grants of other programs, etc., is called a grant function. The amount by which the support level is reduced with increasing income is called the program tax function. With this terminology, both positive and negative tax programs have a tax function that begins with zero tax paid at zero income and indicates positive taxes paid over some positive range of income. Because in the public assistance programs the tax paid rises with income and the support level is constant, there is a point where the net transfer is zero. This is the tax breakeven point, indicated by C in Figure 1. Because participation in public assistance programs is voluntary, no household would continue to participate if the tax function were to specify higher taxes beyond the tax breakeven point. No public assistance programs tax income above, and most terminate eligibility with income at or below, the tax breakeven point.

Household Structure

In the SIME/DIME Experiment, the family is chosen as the relevant unit with regard to economic decisions. SIME/DIME families may or may not correspond to family or household units defined by such social conventions as marriage and legal paternity, as defined by the various positive tax and public assistance programs. Because any particular experiment family member may or may not be included in any of the tax units, our objective in this study is the expected tax function faced by SIME/DIME participants. Expected tax functions would indicate lower taxes and marginal tax rates than would tax functions established over samples of known participants, because the expected tax functions are weighted by the probability that an individual participates.

Deviation from the Statutory Functions

So far we have made no distinction between income reported, upon which the grant computation is necessarily based, and true income. Nor have we raised the possibility that the welfare department may not accurately administer the statutory tax functions. Labor supply behavior is assumed to be based upon true income, not upon that fraction of income reported to any particular positive tax or public assistance program. Effective marginal tax rates will be affected by the relationship between reported income and true income, and by the degree of administrative discretion. There is ample evidence (Barr and Hall, 1973; Rowlatt, 1972; Heffernan, 1973; Lure, 1973) that prior to 1969 when the AFDC program tax rate was 100%, the state welfare departments did not succeed in administering the 100% tax rate on wage earnings. One of the major loopholes of that era was thought to be the work-related expense deduction. In principle, work-related expenses represent income that cannot be consumed and, as such, were reimbursed by the AFDC program, whose intent is to provide near-minimum subsistence. However, if work-related expenses are over-reimbursed in such a way that they rise with wage income, then the effective AFDC tax rate would be reduced. Such variations of the effective tax function are the result of administrative discretion.

A second source of deviation is the result of the household structure definitions embodied in the statutes. The legally defined household may differ considerably from the economically relevant household. In the AFDC program, the AFDC support unit depends upon the legal paternity of the children; thus, it is not uncommon for the current male head of the family to be excluded from the AFDC taxation unit. His AFDC tax rate is zero in this case. If he were legally to adopt the children, then his tax rate would become the effective AFDC tax rate. A teenage child who has earnings can be defined out of the AFDC family, thereby reducing his tax rate to zero. In the Food Stamp Program the household is very loosely defined, providing ample opportunity for maximizing disposable income.

A third source of variation comes from special deductions from taxable income. All public assistance programs exempt substantial amounts of income in arriving at taxable or "adjusted" income. Many of these deductions are income dependent, such as the deduction of 5% of gross income allowed in the public housing programs. In the Food Stamp Program, the deduction of rent in excess 30% of income net of all other deductions acts to increase the tax rate.

A fourth and, currently, probably the most important source of variation is caused by varying standards of income reporting. Positive tax programs collect a major fraction of their taxes through wage withholding. Not all earnings are subject to withholding, and the accuracy of income reporting can be expected to vary with the ease with which income can be hidden. Most illegal income, such as that from prostitution, drug dealing, and theft, probably escapes all existing income measures. Public assistance programs rely on the reporting of income by participating households. The strictest standards are enforced by the AFDC program, followed by the public housing programs. The AFDC program has devoted considerable resources to "quality control" since 1970. The standard of living of public housing households, at least so far as it is reflected in household furnishings, is relatively easy to check. The Food Stamp Program has been notoriously lax in enforcing income reporting until very recently. Underreporting of income can have a dramatic effect on the effective marginal tax rates. For example, it has been shown that about 62% of the earnings of female heads is reported to the AFDC program.* Let the relationship between reported wage income, E^R, and true wage income, E, be:

$$E^R = .62E \ ,$$

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*"The Reporting of Income to Welfare and a Proposed Audit Procedure," H. Halsey, M. Kurz, R. Spiegelman, and A. Lehrman, Stanford Research Institute, March 1976. This study suggests that only 60% of the earnings of AFDC families are reported to the Welfare Department. (Copy available upon request.)

then

$$\frac{\partial T_A}{\partial E} = \frac{\partial T_A}{\partial E^R}\frac{dE^R}{dE} = .62\left(-\frac{2}{3} + \frac{\partial T}{\partial E} + \frac{\partial W}{\partial E}\right) \quad .$$

Where T_A is the AFDC implicit tax function, T is positive income taxes, and W is work related expenses. The effective marginal tax rates are, in this not unrealistic example, only 62% of the administrated reduced form tax rates.

Because of the potential for discrepancy between the statutory tax functions and the effective tax functions, it is imperative that empirical tax functions be estimated. Some promising methods of estimating tax functions are explored in the next section. Sections III, IV, and V describe the statutory and empirical tax functions for the AFDC, Food Stamp, and Public Rent Support programs in detail.

II THEORY

The Budget Constraint for Families on Public Assistance

The gross income of families that benefit from public assistance programs is wage or earned income plus nonwage income. Nonwage income is composed of private source income, such as interest from bank accounts, inheritances, and insurance settlements; and public source income. Public source income is composed of nonpublic assistance income, such as unemployment insurance and public assistance income.

Disposable income is gross income, minus that portion that goes to nonutility-producing expenditures. Taxes are usually categorized as nonutility producing, on the grounds that the relationship between taxes paid and benefits received is tenuous at best. Work-related expenses are often mentioned as another category that should be excluded. In this report we take the position that most work-related expenses are utility producing, and, therefore, we include them in disposable income, Y_d.

$$Y_d = wL + Y_N + \Sigma G_i - \Sigma T_j \quad , \tag{1}$$

where w is the wage rate, L is hours worked, Y_N is nonwage income from public and private sources exclusive of the grants of public assistance programs, the G_i are the grants of public assistance programs, and the T_j are the taxes of positive tax programs. The index, i, runs over the public assistance programs in which the household participates. The index, j, runs over the positive tax programs the household is subject to.

Many public assistance programs levy an implicit tax on income by reducing the benefit with rising income. This is true of the AFDC, Food Stamp, and Public Housing programs, which are the subject of this report. The grant can be written as the support level, S_i, which is the amount a family with no other income receives, minus the implicit tax function, T_i,

$$G_i = S_i - T_i \quad . \tag{2}$$

Rewriting the budget constraint, we have,

$$Y_d = wL + Y_N + \Sigma S_i - \Sigma T_i - \Sigma T_j \quad . \tag{3}$$

The support levels are components of nonwage income, and implicit income taxes are effectively no different from positive income taxes. Arranging the i and j indexes to run consecutively, we can write the budget constraint,

$$Y_d = wL + Y_N + \Sigma S_i - \sum_k T_k \quad , \tag{4}$$

where k now ranges over the sum of the ranges of i and j. The public assistance grant now appears as an addition to nonwage income and an addition to the set of taxes.

The Total Marginal Tax Rate

Let U be the utility function, ℓ be hours of nonlabor market activity, and H be the total number of hours per period. Then,

$$U = U(Y_d, \ell) = U(Y_d, H - L) \quad . \tag{5}$$

Maximizing U, subject to the budget constraint, we find the rate of substitution between disposable income and leisure, w*,

$$\frac{\partial U/\partial \ell}{\partial U/\partial Y_d} = \left(1 - \frac{\partial \Sigma T_k}{\partial wL}\right) w = w^* \tag{6}$$

from the first order conditions. The total marginal tax rate on earned income, $\partial \Sigma T_k / \partial wL$, is the quantity needed to correct the gross wage rate, w, to the economically relevant net wage rate, w*.

Each T_k is determined by a structural positive or implicit tax function dependent on income, positive taxes, and the grants of other transfer programs. The tax equations are interdependent because they interact through taxation of the grants of other programs and through the reimbursement of positive taxes. Because of the interactions, we cannot simply sum the individual program structural marginal tax rates

on earned income. In general, the T_ks are determined by a set of simultaneous structural equations. A way to handle the interactions systematically is to solve the system for a reduced form set of equations that no longer interact. The total tax function is the sum of the reduced form tax functions of the set of programs in which a family participates. The total marginal tax rate on earned income is the sum of the reduced form marginal tax rates on earned income.

AFDC, Food Stamp, and Public Housing Implicit Tax Functions

Within each program, there is a means of determining the tax or grant. In the AFDC, Public Housing, and the Social Security withholding programs, this is a step-by-step calculation that results in a continuous tax function with discontinuous first derivative. In state and federal income tax and the Food Stamp Program, a table is used that relates taxable income to the tax. The table is a step function with either zero or very large marginal tax. For the programs with tabular statutory tax functions, we assume that the smooth function drawn through the middle points of the steps is the effective statutory function. In somewhat simplified form, the statutory, or structural equations of the positive tax, AFDC, Food Stamp, and Public Housing programs are

$$T_p = t_p(E^R + Y_N^R) \tag{7a}$$

$$G_A = S_A - Y_N^R - t_A E^R + T_P + W^R \tag{7b}$$

$$G_F = S_F - T_{f1}(Y_N^R + G_A) - t_{f2}E^R \tag{7c}$$

$$G_H = S_H - t_H(Y_N^R + G_A + G_F) - t_H E^R \quad , \tag{7d}$$

where T is positive taxes paid, S is the support level, G is the grant, Y_N is nonwage income exclusive of public transfers, E is earned income, and W is work-related expenses reimbursed in the AFDC program. The subscripts P, A, F, and H refer to the positive tax function, the AFDC program, the Food Stamp Program, and Public Housing, respectively.

The superscript R indicates that the structural equations are functions of quantities reported to the administering agencies by the grant recipients, and not necessarily the actual quantities.

Income Underreporting

The empirical evidence suggests that income is very much underreported to public welfare agencies. Because the tax functions we seek are functions of actual income rather than income reported to the welfare department, it is necessary to augment the set of structural tax functions with income-reporting functions. In principle, a different income-reporting relation is possible for each public assistance program. For expositional purposes, we assume here that income is consistently reported to all public welfare agencies, although not necessarily correctly reported.

$$E^R = E\left(Y_N, E, F\right) \tag{8a}$$

$$Y_N^R = N\left(Y_N, E, F\right) \quad , \tag{8b}$$

where F is a vector of socioeconomic and family structure variables, and Y_N and E are the actual quantities.

Reduced Form Tax Functions

The augmented set of structural equations is recursive, so were it not for the suspicion that the error terms are correlated across programs, we could estimate each structural equation separately. It seems likely that households receiving preferential treatment by one program are likely to receive it from others, or succeeding in underreporting income to one program probably succeeds in underreporting to other programs. Therefore, positive correlation is likely to exist among the error terms, which would result in biased estimation were we to estimate the structural equations directly. Moreover, we are principally interested in the total tax function and the total marginal tax rate, which are easily derived from the reduced form tax functions, because there are no interactions between the reduced-form equations.

A Partially Reduced Form

The reduced-form equations can either be derived directly or they can be derived by the following two-stage process. In the first stage, the reduced-form equations of the structural system, Equations (7a) through (7d) are derived. The reduced forms are augmented by the income-reporting Equations (8a) and (8b).

$$T_p = \alpha_{11} Y_N^R + \alpha_{12} E^R + \varepsilon_1 \tag{9a}$$

$$T_A = S_A - G_A = \alpha_{21} Y_N^R + \alpha_{22} E^R - w + \varepsilon_2 \tag{9b}$$

$$T_F = S_F - G_F = \alpha_{31} Y_N^R + \alpha_{32} E^R + \alpha_{33} S_A + \varepsilon_3 \tag{9c}$$

$$T_A = S_H - G_H = \alpha_{41} Y_N^R + \alpha_{42} E^R + \alpha_{43} S_A + \tag{9d}$$

$$+ \alpha_{44} S_F + \varepsilon_4$$

$$E^R = \alpha_{51} Y_N + \alpha_{52} wL + \alpha_{53} F + \varepsilon_5 \tag{9e}$$

$$Y_N^R = \alpha_{61} Y_N + \alpha_{62} w_L + \alpha_{63} F + \varepsilon_6 \quad . \tag{9f}$$

Equations (9a) through (9d) can be estimated on the basis of welfare department data or calculated from the legal structure in the absence of administrative distortion of the structural tax functions. Estimation of Equations (9a) through (9d) will give insight into the nature and degree of administrative distortion. SIME/DIME interview data are used as proxy for actual income in the income-reporting equations. Equations (9e) and (9f) indicate the type and degree of income misreporting to welfare agencies. The effective tax functions are derived by solving Equations (9a) through (9f) for the fully-reduced-form tax functions in which the arguments are actual income rather than reported income. These are Equations (10a) through (10d) below.

Fully Reduced Form

Alternatively, the reduced-form equations of the augmented system can be defined in a single step. In this case, the reduced-form equations are written directly in terms of actual income arguments.

$$T_P = \beta_{11}Y_N + \beta_{12}E + \varepsilon_1 + \alpha_{11}\varepsilon_6 + \alpha_{12}\varepsilon_5 \qquad (10a)$$

$$T_A = \beta_{21}Y_N + \beta_{22}wL + \beta_{23}w + \beta_{24}F + \varepsilon_2 + \alpha_{21}\varepsilon_6 \qquad (10b)$$
$$+ \alpha_{22}\varepsilon_5$$

$$T_F = \beta_{31}Y_N + \beta_{32}wL + \beta_{33}S_A + \beta_{34}F + \varepsilon_3 + \alpha_{31}\varepsilon_6 \qquad (10c)$$
$$+ \alpha_{32}\varepsilon_5$$

$$T_H = \beta_{41}Y_N + \beta_{42}wL + \beta_{43}S_A + \beta_{44}S_F + \beta_{45}F \qquad (10d)$$
$$+ \varepsilon_4 + \alpha_{41}\varepsilon_6 + \alpha_{42}\varepsilon_5 \ .$$

Estimation of the fully reduced form provides the effective tax functions in a single step. However, the distinction between administrative distortion and income underreporting is lost.

Estimation of Effective Public Assistance Tax Functions

AFDC, Food Stamps, and Public Housing households are defined under differing sets of rules. The SIME/DIME families are defined under still different rules. One result is that a member of the SIME/DIME family may or may not be in the public assistance family. Nearly all female heads are members of all family/household definitions. Male heads, however, are often excluded from public assistance families, particularly

the AFDC family, unless they are legally married to the female head. The children of such male heads are usually excluded too. Teenage children may not be included in public assistance if they earn enough so that the tax on their earnings exceeds their component of the support level. Therefore, the SIME/DIME family often differs from the public assistance family. In this situation, the most informative method of estimating public assistance tax functions for the SIME/DIME population would be the following:

- Estimate conditional program tax functions for those SIME/DIME households which correspond exactly to public assistance program households.
  - Estimate partially reduced form administered tax functions
  - Estimate income reporting functions
  - Estimate fully reduced form tax functions directly.
- Estimate the probability that SIME/DIME family members are included in the public assistance household.
- Compute expected effective tax functions by weighing each SIME/DIME family member's conditional tax function by the probability that he is a member of the public assistance family.

With this estimation strategy, direct comparisons could be made between reduced-form statutory tax functions and administered tax functions--the comparison usually made in previous studies.

Such a study was not undertaken here, because the identification of congruent families must be undertaken by hand, a time-consuming process, and then could only be done for the AFDC program in 1970 and 1971, the years for which data are presently available. The method adopted in this report was to solve the augmented system of equations for the fully reduced form, and estimate tax functions over SIME/DIME families. The tax functions so estimated are the expected effective tax functions which implicitly incorporate the probability of participation by SIME/DIME family members. In the case of the female head, the expected effective tax function is nearly identical to the fully-reduced-form tax function estimated over congruent families, because nearly all SIME/DIME and public assistance families have a female head.

Data Sources

Our data sources are the SIME and DIME interviews and the Seattle and Denver Department of Welfare AFDC records, covering the period between January 1, 1970, and December 21, 1971. The SIME Enrollment and First Periodic interviews cover 1970 and 1971. The DIME Pre-enrollment Interview covers 1970, and the DIME Enrollment Interview covers 1971. Data from the interviews are retrieved into intermediate files, from which analysis files were constructed.

The principal intermediate files used in this study are the Job File, the Benefits, Expenses, and Subsidized Housing File, and the updated version of the Subsidized Housing File. The Job File contains information on wages, hours of work, earnings, unemployment benefits, and workmen's compensation on a monthly basis. The Benefits, Expenses, and Subsidized Housing File provided data on food stamps, general assistance, social security, veteran's benefits, private source nonwage income, insurance settlements received, alimony received, and child care costs. The Public Housing File provided rent and mortgage paid in subsidized housing in Seattle and in Denver 1970.

Family structure data, as well as an alternative source of rent, mortgage, and child care data were provided by the 1975 Quarterly Labor Supply (QLS) File. This file contains both quarterly and middle-month-of-the-quarter data. We applied middle-month data to all months of the quarter in our monthly file. The 1975 Quarterly Labor Supply File was the control file for our sample selection. Household records appear on this file from the date of enrollment for as long as the family remains intact, that is, until a dual-headed family splits or a single-headed family acquires an additional head. Unfortunately, Chicano households, which comprise about one-third of the DIME sample, are not on this file. A household record appears on our monthly analysis files for each month in which the household received an AFDC grant as indicated by the Welfare File or reported receiving benefits from AFDC, Food Stamps, Child Care, Rent Support, or Mortgage Support as indicated on the 1975 QLS.

The welfare department files are in event-record format; that is, a change of action form appears on each date on which the grant is changed. Each form contains prior period data and subsequent period data. A monthly report was constructed from the event record and merged with the SIME/DIME interview data by family identification number.

Analysis Files

A set of average monthly analysis files was constructed in which each record is the average of all observations within the calendar year for which the relevant public assistance benefit is positive. For example, if a family were on AFDC for x months of year, y, then there will be a single record for the family in the y-year file in which all monetary variables are averaged over the x months. Family structure data are taken from the middle month of the x-month period.

In all, 12 analysis files were constructed, one for each of the three programs, AFDC, Food Stamps, and Public Housing Rent, separately in Seattle and in Denver and for 1970 and 1971. In the analysis, the 2 years' data in Seattle were combined, but the Denver 1970 and 1971 files were analyzed separately because, as the Denver experiment began a year later than the Seattle experiment, the Denver 1970 data is from the preenrollment period and exists in a different format (and on a different computer) than the experimental period data.

III THE AFDC PROGRAM

Introduction

The objective of the AFDC program is to encourage the care of dependent children in their own homes or in the homes of relatives through financial assistance and to aid such parents or relatives to attain or maintain a capability for self-support. The coverage of the AFDC program has been successively broadened over the years, but it is still restricted to families with dependent children.

The AFDC grant calculation has always consisted of two steps, the determination of the level of need and the determination of the cash grant. The level of need is set by the state at the subsistence level for the AFDC family. Prior to the adoption of the thirty-and-one-third rule in 1969, the cash grant was the difference between the level of need and the household disposable income, in principle. Many states, however, found that they lacked the budget to support all AFDC families at the level of need. A variety of funds-rationing methods were devised, which consisted of establishing a support level below the need level. Families with little or no income received the support level rather than the need level. Income up to the difference between the level of need and the support level was untaxed. Earnings above this range were taxed 100%.

In the thirty-and-one-third era, setting the support level below the need level extends the range of untaxed earnings beyond $30 in some states. In others, a reduction proportional to the level of need is made, but the thirty-and-one-third deduction from earned income remains the same. In Washington, the support level was set at the need level until April 1971 when a reduction in the support level was implemented. The thirty-and-one-third deduction was unaltered. In Colorado, the support level was always at the need level during 1970 and 1971.

At first, the thirty-and-one-third disregard was implemented differently in Seattle and Denver. In Seattle, the "thirty-and-one-third rule," as it came to be known, was first applied to earnings net of other deductions. In July of 1970, the thirty-and-one-third deduction was applied to gross earnings, as it had been since the beginning in Denver. Although the interpretation of the thirty-and-one-third rule is the same in Seattle and Denver subsequent to the middle of 1970, differences in the programs remain. In the course of operations, overpayments are occasionally made and subsequently discovered. Overpayments can be the cause of an administrative mistake or of a deliberate reporting error on the part of the recipient. In Seattle, such overpayments are recovered over time through small reductions in the grant which appear in the grant calculations as grant deductions. Also, subsequent to April 1, 1971, the support level can be set below the level of need for statewide budgetary reasons. Support level reductions appear in the welfare department records as grant reductions. Neither of these reductions in the AFDC grant occur in Denver. There a record of overpayments is retained and legal action is taken to recover them if necessary, but only after family income has risen to the extent that disposable income is well above the need level, or, in most cases, the family is off the AFDC program.

Statutory AFDC Tax Function

The AFDC grant function in use in the State of Washington between July 1, 1969, and July 1, 1970, was:

$$G = S-D \begin{cases} -Y_N & \text{if } E-T_X-W-30 < 0 \\ -Y_N - \frac{2}{3}(E-T_X-W-30) & \text{if } E-T_X-W-30 \geq 0 \end{cases}, \qquad (11)$$

where

G = AFDC monthly grant

S = monthly level of need

Y_N = monthly non-wage income

E = gross earnings

T_X = taxes and mandatory deductions from earnings

W = work related expenses

D = deductions (corrections for past overpayments).

The grant function can be written

$$G = S - D - T_A(Y_N, E, T_X W) \tag{12}$$

where T_A is the AFDC tax function. After June of 1970 the thirty-and-one-third rule was applied to gross rather than net earned income. The tax function became

$$T_A = \begin{cases} Y_N - T_X - W & \text{if } E < 30 \text{ and } T_A \geq 0 \\ Y_N - T_X - W + \frac{2}{3}(E-30) & \text{if } E \geq 30 \text{ and } T_A \geq 0 \\ 0 & \text{if } T_A < 0 \ . \end{cases} \tag{13}$$

In Denver, the thirty-and-one-third rule was applied to gross earnings from the first, and there are no grant reductions or overpayment deductions; however, work-related expenses were restricted to a flat $30.00 for working households between July 1, 1970, and September 1, 1974.* For this period the Denver AFDC tax function can be written

*In Denver a record of overpayments is kept. When family income rises sufficiently, voluntary repayment (in installments if necessary) is requested. When income has risen sufficiently that the family is no longer eligible for AFDC, legal action may be taken to recover overpayments if voluntary restitution is not agreed upon.

$$T_A = \begin{cases} Y_N - T_X & \text{if } E < 75 \text{ and } T \geq 0 \\ Y_N - T_X + (E-75) & \text{if } E \geq 75 \text{ and } T \geq 0 \\ 0 & \text{if } T < 0 \ . \end{cases} \qquad (14)$$

Reduced Form AFDC Tax Function

To compute the reduced form of the tax functions, the income-dependent components of T_X and W are needed for Seattle and of T_X for Denver. The treatment of work-related expenses has long been a nation-wide issue. Many observers claim that work-related expenses are a major "loophole" in the AFDC program. This is obviously not the case in Denver between 1969 and late 1974 because work-related expenses averaged less than $30 a month for working families prior to July 1970 and were restricted to that amount thereafter. The importance of the issue can be seen because the states were forced to pay actual related expenses rather than an arbitrary amount, as a result of judicial decisions brought about by lawsuits in 1974. In Seattle an arbitrary limit was never imposed, but the mean value of work-related expenses reimbursements was $13.20 in 1970 and 1971. Table 8 (page 33) shows that W is approximately 4% of female head earnings in Seattle. T_X is composed mostly of federal income tax and social security withholding and in Denver, state income tax withholding. The legal tax rates of federal, state, and social security withholding are given in Table 4. The complexity of the positive tax functions is reflected in the reduced form of the AFDC tax function.

A representative view of the AFDC reduced-form tax function can be obtained by restricting our attention to the tax function faced by female-headed AFDC families of four. Positive tax rates for these families are given in Tables 5 and 6. For the work-related expenses function we have

$$W = .04E \qquad (15)$$

from Table 8. Approximating the positive tax rates in the earnings range $0-$300 by 5%, $300-$650 by 22%, and above $650 by 16%, we can write

Table 4

TAX RATES FOR FEDERAL, STATE, AND SOCIAL SECURITY WITHHOLDING

1970

Federal Income Tax Withholding Rates

Number of Exemptions	Monthly Earnings Range and Tax Rate			
	0%	21%	15%	17%
2	0-200	200-320	320-500	500-920
3	0-256	256-376	376-560	560-960
4	0-312	312-440	440-640	640-1000

Colorado State Income Tax Withholding Rates

Number of Exemptions	Monthly Earnings Range and Tax Rate			
	0%	2.0%	2.5%	3.0%
2	0-152	152-360	360-440	440-580
3	0-220	220-380	380-460	460-640
4	0-288	288-392	392-500	500-720

Social Security Yearly Withholding Rates: 0-7,800,4.8%; >7,800,0%

1971

Federal Income Tax Withholding Rates

Number of Exemptions	Monthly Earnings Range and Tax Rate			
	0%	14%	17%	16%
2	0-196	196-296	296-460	460-840
3	0-248	248-352	352-520	520-880
4	0-304	304-420	420-560	560-960

Colorado State Income Withholding Rates

Number of Exemptions	Monthly Earnings Range and Tax Rate			
	0%	2.0%	2.5%	3.0%
2	0-152	152-360	360-440	440-580
3	0-220	220-380	380-460	460-640
4	0-288	288-392	392-500	500-720

Social Security Yearly Withholding Rates: 0-7,800,5.2%; >7,800,0%

Table 5

TOTAL POSITIVE TAX WITHHOLDING RATES FOR FAMILY OF FOUR IN DENVER

1970		1971	
0-288	4.8%	0-288	5.2%
288-312	6.8%	288-304	7.2%
312-392	27.8%	304-392	21.2%
392-440	28.3%	392-420	21.7%
440-500	22.3%	420-500	24.7%
500-640	22.8%	500-560	25.2%
640-650	24.8%	560-650	24.2%
650-720	20.0%	650-720	19.0%

Table 6

TOTAL POSITIVE TAX WITHHOLDING RATES FOR A FAMILY OF FOUR IN SEATTLE

1970		1971	
0-312	4.8%	0-304	5.2%
312-440	25.8%	304-420	19.2%
440-640	19.8%	420-560	22.2%
640-650	21.8%	560-650	21.2%
650-1000	17.0%	650-960	16.0%

the statutory reduced form of the post-June 1970 Seattle AFDC tax function as

$$T_A = \begin{cases} Y_N & \text{if } E < 35 \\ Y_N + .58(E-35) + C_1 & \text{if } 35 \leq E < 300 \\ Y_N + .36(E-300) + C_2 & \text{if } 300 \leq E < 650 \\ Y_N + .42(E-650) + C_3 & \text{if } 650 \leq E < 1000 , \end{cases} \tag{16}$$

where the constants C_1, C_2, and C_3 are chosen to make the tax function continuous at the changes in marginal tax rate.

Approximating the positive tax rates in the earnings range \$0-\$300 by 5%, \$300-\$650 by 24%, and above \$650 by 19% (positive tax rates are higher in Denver due to state income tax withholding), we can write the Denver statutory reduced form AFDC tax function as

$$T_A = \begin{cases} Y_N & \text{if } E < 81 \\ Y_N + .62(E-81) + C_1' & \text{if } 81 \leq E < 300 \\ Y_N + .43(E-300) + C_2' & \text{if } 300 \leq E < 650 \\ Y_N + .48(E-650) + C_3' & \text{if } 650 \leq E < 1000 . \end{cases} \tag{17}$$

Treating the empirically derived work-related expenses function, Equation (15), as part of the legal system, we have the reduced form AFDC tax functions upon which the econometric specification of the empirical tax functions will be built.

Econometric Specification

The statutory-reduced-form AFDC tax functions derived above are the basis of the econometric specification of effective tax functions. The statutory tax functions indicate that nonwage income from all sources is taxed at a 100% rate. Earned income up to an amount, E_b (equal to $35 in Seattle and $81 in Denver), is untaxed. Earned income above E_b is taxed beginning at a 58% rate in Seattle and beginning at a 62% rate in Denver with the rates falling as federal, and in Denver, state tax reimbursement rates rise.

The statutes make no provision for differential treatment of income from different sources within nonwage and earned income categories, nor do they indicate that the AFDC support level may depend on income. There is a good reason to suspect, however, that taxable income is underreported to the welfare departments which administer the AFDC program.* In this situation, those income components which are more visible and which are more vigorously pursued by the welfare department are likely to be subject to higher tax rates. The AFDC program has made strong efforts to enforce alimony and child support payments by absent fathers, thus it is likely that this component of nonwage income will be subject to relatively high tax rates. Nonwage income from public sources is more visible than is nonwage income from private sources. We therefore enter nonwage income in separate components into the specification.

There are family structure differences between the AFDC family and the SIME/DIME family. Since we are interested in the expected AFDC taxes and marginal tax rates faced by members of families as defined by economic rather than other considerations, we choose the SIME/DIME family as our unit of observation. Earned income is excluded from AFDC taxation if earned by a child aged under 16 or by a student aged between 16 and 21 who is not a full-time worker. Male heads not legally married to the female head of the family may not be in the AFDC family. If not, his

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*Halsey, Kurz, Spiegelman, Waksberg, "The Reporting of Income to Welfare: A Study in the Accuracy of Income Reporting," Research Memorandum 42, August 1977.

income will be untaxed. Male heads who do not legally adopt children of a previous union are not held responsible for their support by the AFDC program. On the other hand, children of a male head by a previous union will not automatically be eligible for AFDC support. Teenage children who are full-time workers could pay an AFDC tax higher than their component of the support level. These teenagers may be defined as no longer dependent and out of the AFDC family, thereby lowering the tax rate on their earnings to zero and reducing the support level. To account for these factors, we allow the tax rates to vary by earned income component as well as by nonwage income component, and we approach the estimation of the AFDC tax functions as a two-stage process. First, we estimate the AFDC support level, then using the estimated support level, we calculate the AFDC tax. We then use the computed AFDC tax as the dependent variable in the estimation of the tax function.*

More formally, to prevent earnings-dependent variations in the support level from biasing† our estimates of the AFDC marginal tax rates,

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*This procedure is econometrically equivalent to restricting the coefficient of the estimated support level variable to one in a regression of the AFDC grant on the support level and tax function variable.

†We have defined the total marginal tax rate on earned income to be

$$1 - \frac{\partial Y_d}{\partial E}$$

where $Y_d = E + Y_N - \Sigma T_j + \Sigma G_i$

and where $G_i = S_i - T_i$,

$$-\frac{\partial G_i}{\partial E} = -\frac{\partial S_i}{\partial E} + \frac{\partial T_i}{\partial E} \quad .$$

The support level, S_i, ought to be independent of earnings in which case $\partial S_i/\partial E = 0$. But suppose the support level is administratively varied in an income-dependent way. Then $\partial S_i/\partial E \neq 0$. Let

$$S_i = \hat{S}_i - f(E) \quad .$$

Where $\hat{S}_i$ is determined by a regression of S_i on the variables which ought to determine the support level by law and excluding earnings variables. Then

$$G_i = \hat{S}_i - f(E) - T_i$$

and we write $T_i + f(E) = (\hat{S}_i - G_i)$ as the effective tax function. And $\partial T_i/\partial E + \partial f/\partial E$ as the effective marginal tax rate.

We construct an instrumental variable derived from a regression of the observed support level on a set of variables other than earnings, which are known to enter the support level regression, these are:

C_1 = the number of children aged 0-5

C_2 = the number of children aged 6-15

NT = the number of children aged 16-20

NNH = the number of nonhead family members aged ≥21

$$HRP = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the current union is greater than zero and the male head has zero earnings.} \\ 0 \text{ otherwise} \end{cases}$$

$$DO = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the current union is zero and the male head has zero earnings.} \\ 0 \text{ otherwise} \end{cases}$$

$$M_1 = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the current union is less than the age of the youngest child and the male head has positive earnings.} \\ 0 \text{ otherwise} \end{cases}$$

$$M_2 = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the current union is between the ages of the youngest and the oldest child and the earnings of the male head are positive.} \\ 0 \text{ otherwise} \end{cases}$$

$$M_3 = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the current union is greater than the age of the oldest child and the earnings of the male head are positive.} \\ 0 \text{ otherwise} \end{cases}$$

$$DP = \begin{cases} 1 \text{ if the family is dual headed and the recorded age of the union is zero and the earnings of the male head are positive.} \\ 0 \text{ otherwise.} \end{cases}$$

$$R = \{ \text{Shelter costs, rent or mortgage.}$$

$$YU = \begin{cases} 1 \text{ if the year is 1971} \\ 0 \text{ if the year is 1970.} \end{cases}$$

The support level depends upon the family size and expenses, largely shelter costs and a food allowance. The constant term reflects the support level of a single female head with no children.* The variables HRP through DP are entered into the specification in an attempt to capture the differences in family structure between the SIME/DIME and AFDC families. Our Seattle and Denver 1971 data are SIME/DIME experimental period data while our 1970 Denver data are preenrollment data. During the experimental period the male head was asked the age of the current union, and often answered either zero years or did not answer. The female head was asked the same question and her answers were more often positive and, when positive, indicated longer duration than those of the male head. The male head's answers as to whether he considers himself in a permanent or semipermanent union were chosen as the more reliable indicator of his relationship to the AFDC family. During the preexperimental period in Denver (1970), all dual-headed families responded that the age of the union exceeded the age of the oldest child. Therefore, in Denver, in 1970, DO, DP, M1, and M2 are uniformly zero. HRP represents the component of AFDC support due an unemployed male head who considers himself

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*In any case the regression would reflect the component of the support level due a single female head. In fact, such AFDC families exist, because a pregnant woman can be eligible for AFDC support before her first child is born.

strongly attached to the family. DO represents the average support due an unemployed male head who is less strongly attached to the family and therefore has a higher likelihood of being outside the AFDC support group. A male head with earnings who is strongly attached to the AFDC family will affect the support level differently depending upon the age of the marriage in relation to the ages of the children. If the children are all older than the age of the marriage, then the AFDC support group is likely to consist of the female head plus her children. If the male head's earnings are substantial, AFDC will require him to support the female head. This effect is captured by M_1 which is expected to have a negative coefficient. If the age of the marriage exceeds the age of the youngest child, then a male head with substantial earnings can be expected to support his children. On the other hand, a male head with small but positive earnings is more likely to be in the AFDC support group, so the sign of the coefficient of M_2 and M_3 is ambiguous. DP captures the average effect of M_1, M_2, and M_3 for families in which the male head is less strongly attached to the family. The sign of DP is expected to be negative.

Empirical Findings

Family Structure and the Support Level

The estimated parameters of the support level function are presented in Table 7. As expected, the constant terms are in the vicinity of the support level for a single female head,* which equals $114 in Denver and a maximum of $155 in Seattle. The coefficients of C_1 and C_2 are in the range of the support level for individual children (in Denver, $29-$39; in Seattle, $20-$48 per month per child, with older children receiving more support). The coefficient of NT, however, is lower than the support

*Although there is no sex discrimination in the AFDC statute, a single male head would have to have at least one child to be eligible for AFDC support. A single female head merely has to be pregnant.

Table 7

SUPPORT LEVEL REGRESSIONS
(Standard Errors in Parenthesis)

	Seattle 1970, 1971	Denver 1970	Denver 1971
Dependent Variable	Observed Need Level - Reduction	Observed Need Level	Observed Need Level
Independent Variable			
C, Constant	148.05	96.544 (5.147)	117.11
C_1, # Children age 0-6	18.97** (1.92)	30.087** (1.904)	30.71** (2.62)
C_2, # children age 6 - 15	35.05** (1.01)	33.501** (1.214)	34.99** (1.57)
NT, # teenage Children, age 16-20	42.29** (2.75)	19.237** (3.219)	31.62** (3.61)
NNH, # nonheads, age ≥21	34.79** (3.69)	-5.639 (7.238)	5.17 (8.97)
HRP, dummy variable	36.51** (5.16)	36.887** (4.039)	52.64** (9.56)
DO, dummy variable	23.60** (6.12)		55.11** (20.02)
M_1, dummy variable (HR3)	-16.84 (22.18)		-34.31** (13.10)
M_2, dummy variable (HR5)	34.62** (12.88)		-83.29** (11.15)
M_3, dummy variable (HR4)	38.75** (7.87)	.296 4.023	31.88** (8.36)
DP, dummy variable	7.89 (6.24)		-20.81 (11.21)
R, shelter costs	.17** (.03)	.146 (.052)	.09 (.05)
Y71	4.69 (2.77)		
σ	38.29	40.089	34.04
R^2	.66	.585	.69
N	791	678	318
$\bar{Y}$	246.51	190.227	207.26

** Significantly different from zero at the 99% confidence level

component in Denver 1970, indicating a divergence between the DIME family definition and the AFDC family definition. Apparently the Denver Pre-enrollment AFDC family contains fewer teenagers than does the DIME family. The enrolled families, however, tend to agree more closely with the AFDC family. The coefficient of NNH exhibits a difference between Seattle and Denver. In Seattle, nonheads tend to be supported by AFDC while in Denver, nonheads tend to be outside the AFDC support group. To the extent that the DIME family definition is consistent with that of the SIME family, this effect results from differences between the Seattle and Denver administration of the AFDC program. The coefficient of HRP is consistent with the component of the support level due a second head of $43 in Denver and $51 in Seattle. The near equality between the coefficient of DO and HRP indicates that the welfare departments of Seattle and Denver support male heads without earnings irrespective of whether they indicated the existence of a permanent or semipermanent union of positive duration in the SIME and DIME interviews. The coefficient of M_1 is negative, as expected, and in Denver 1971 is nearly equal to the support component of the female head of $44. In Seattle, the coefficient is much smaller and indicates that male heads with positive earnings are not as regularly expected to support the female head as they are in Denver. In Seattle, the coefficients of M_2 and M_3 are positive, indicating that male heads with earnings are supported by AFDC. The coefficient of DP is also positive although much smaller, indicating that the male heads with positive earnings who are loosely attached to the family are likely to receive little or no support, but do not support children either. In Denver 1971, the coefficients of M_2 and DP are strongly negative, while the coefficient of M_3 is positive indicating that male heads are required to support some of the children, if the age of the marriage falls within the range ages of the children and earnings are positive, or even if the male head is not strongly attached to the family. If, however, the reported age of the marriage exceeds that of the oldest child, then evidently the union is rather stable and if the family is on AFDC, the male head is likely to be receiving AFDC support. The coefficient of the shelter cost variable, R, is positive and significantly different from zero in Seattle and in

Denver 1970. In Denver 1971, the coefficient of R is slightly smaller, .09 as opposed to .15, and the variance is about the same, resulting in significance at the 90% level of confidence, but not at the 95% level. The coefficient of Y71 is not significantly different from zero and is rather small. This is probably due to the introduction of the support level reduction in April 1971, which nearly offset the increase in the level of need due to inflation.

The support level regressions give a slightly different picture of the AFDC program in Seattle and in Denver. The Seattle AFDC support group appears to be much more consistent with the SIME family than the Denver AFDC support group is with the DIME family. Nonheads over age 20 are included in the Seattle AFDC support group. Male heads tend to be included in the Seattle AFDC support group regardless of whether they have positive earnings, as long as they appear to be firmly attached to the family. In Denver, nonheads over age 20 tend not to be in the AFDC support group and male heads with earnings tend to be excluded from the support group and to be required to support the female heads and some of the children whether or not they are firmly attached to the family. An exception is the case of those families that appear to be relatively stable. When the male head reports an age of the union exceeding the age of the oldest child, he tends to be included in the AFDC support group irrespective of whether his earnings are positive.

Work-Related Expenses in Seattle

The reduced forms of the AFDC tax functions, Equations (7) and (8), depend on the work-related expenses function. In Denver, we know the function to be a constant, $w = 30$, subsequent to the middle of 1970, and to have smaller magnitude before that. In Seattle, however, work-related expenses were never restricted to a constant value, and could quite possibly vary with earnings. Since a variation of work-related expenses with earnings would affect the specification of the tax function (under our assumption that work-related expenses are mostly consumption), an empirical work-related expenses function is in order.

The sample over which the Seattle work-related expenses function is estimated is that group for which work-related expenses are positive. This sample consists of 89 observations over the 1970-1971 period. The dependent variable is work-related expenses reimbursed, as indicated by the Seattle AFDC records. The independent variables are the earnings of the male head, the earnings of the female head, and the earnings of other members of the family as recorded by SIME.

The ordinary least squares (OLS) regression results are presented in Table 8. The coefficient of EMH, earnings of the male head, is not only very close to zero, it is not statistically different from zero even at a very low level of confidence. The coefficient of EFH, earnings of the female head, equals 3.5% and is statistically significantly nonzero at the 99% confidence level. Somewhat surprisingly, the coefficient of EO, earnings of other family members, is equal to 10% and is statistically significantly nonzero at the 99% confidence level.

Reduced Form Effective AFDC Tax Functions

The statutory reduced form AFDC tax functions, Equations (6) and (7), are the basis of the specification of the empirical functions. The dependent variable is the computed AFDC tax which is the difference between the estimated support level and the observed AFDC grant. The sources of the AFDC grant observations are the Seattle and Denver welfare department AFDC program records.

Nonwage income is 100% taxed according to the AFDC statutes, but here it was divided by source into nonwage income from private sources and nonwage income from public sources in accordance with the suggestion made above, that income from different sources may be differentially reported to the welfare department by the AFDC recipient and thus bear different marginal tax rates. Along the same line of reasoning, private source nonwage income is further divided into alimony received and other types of private source nonwage income. Alimony is usually the largest component of private source nonwage income. During the experimental period, its mean values (over the entire sample) are $6.28 in Seattle and $2.64 in Denver. Nonalimony private source nonwage income has corresponding

Table 8

AFDC WORK-RELATED EXPENSES REGRESSION
(Standard Errors in Parenthesis)

Seattle 1970 and 1971

Dependent Variable: work-related expenses, Seattle Welfare Department Record

Independent Variable		Coefficient
C, constant		4.549
EMH, earnings male head		-.005 (.012)
EFH, earnings female head		.035** (.006)
EO, earnings of other family members		.105** (.037)
	σ	10.451
	R^2	.365
	N	89
	$\overline{Y}$	13.204

** Significantly different from zero at the 99% level of confidence

mean values of $1.13, $.44. In the preexperimental period (Denver 1970), this situation is reversed. Then alimony has a sample mean of $1.64 while other private source nonwage income has a sample mean of $3.27.

The division of earned income into components by source poses a problem in that the total of a family's earned income is untaxed over the range between 0 and E_b (E_b = $35 in Seattle and $81 in Denver). Therefore, the range of taxable earnings of one family member depends upon the amount of earnings reported by other family members. The way around this difficulty which we choose is to use only families with taxable income. Legally, all earnings should be taxed at the same rate for this group. The effect of the declining marginal tax rate is allowed for in the case of the earnings of the female head by the inclusion of the square of her taxable earnings. The independent variables which enter the reduced form AFDC tax functions are

YNP = private source non-wage income, excluding alimony and and benefits of other public assistance programs

A = alimony

YNG = public source non-wage income

EMH = earnings of the male head

EFH = earnings of the female head

EFH^2 = earnings of the female head squared

EO = earnings of other family members.

The regression results for the taxable income sample are presented in Tables 9 and 10. In the linear regressions, none of the coefficients of YNP are statistically significantly different from zero. The only sample with an appreciable amount of private source, nonalimony nonwage income, Denver 1970, has the smallest coefficient, amounting to -5%. The coefficients of YNP in the experimental period are relatively large but of opposite signs. This wide variation among statistically insignificant coefficients is probably due to inconsistent reporting and the small

Table 9

AFDC TAX REGRESSIONS - TAXABLE INCOME - LINEAR
(Standard Errors in Parenthesis)

Dependent Variable	Statutory Value	Seattle 1970, 1971 Estimated Tax	Denver 1970 Estimated Tax	Denver 1971 Estimated Tax
Independent Variable				
C, constant	0.00	-6.475	-16.220** (6.262)	-13.381
YNP, private source nonwage income	1.00	-.212 (.416)	-.050 (.135)	.584 (1.081)
A, alimony	1.00	.800** (.148)	.642** (.202)	.876** (.207)
YNG, public source nonwage income	1.00	.132** (.050)	.311** (.102)	.231 (.164)
EMH, earnings male head	>.40	.051* (.020)	.048** (.015)	.042 (.022)
EFH, earnings female head	>.40	.257** (.021)	.204** (.025)	.221** (.033)
EO, earnings of other family members	>.40	.145** (.052)	.040 (.034)	-.048 (.048)
σ		53.360	50.925	48.816
R^2		.412	.224	.348
N		250	314	148
$\overline{Y}$		46.585	24.96	39.495

* Significantly different from zero at the 95% confidence level
** Significantly different from zero at the 99% confidence level

Table 10

AFDC TAX REGRESSIONS - TAXABLE INCOME - DECLINING RATE
(Standard Errors in Parenthesis)

Dependent Variable	Statutory Value	Seattle 1970, 1971 Estimated Tax	Denver 1970 Estimated Tax	Denver 1971 Estimated Tax
Independent Variable				
C, constant	0.00	-4.258	-19.659** (7.428)	-21.476
YNP, private source nonwage income	1.00	-.227 (.418)	-.000 (.147)	.652 (1.083)
A, alimony	1.00	.806** (.148)	.634** (.202)	.860** (.208)
YNG, public source nonwage income	1.00	.130** (.050)	.306** (.102)	.217 (.165)
EMH, earnings male head	>.40	.048* (.021)	.054** (.016)	.054* (.025)
EFH, earnings female head	>.50	.222** (.056)	.256** (.065)	.319** (.110)
EFH^2, square of earnings female head	<-.0002	.00007 (.00010)	-.00012 (.00014)	-.00021 (.00023)
EO, earnings of other family members	>.40	.134* (.054)	.044 (.034)	-.035 (.051)
σ		53.422	50.946	48.839
R^2		.413	.2259	.352
N		250	314	148
$\bar{Y}$		46.585	24.963	39.495

* Significantly different from zero at the 95% confidence level
** Significantly different from zero at the 99% confidence level

fraction of the sample with positive amounts of such income. The coefficients of A, alimony received, are in the range of 80% in the experimental period and neither is statistically different from the statutory value of 100% at the 95% level of confidence. In the preexperimental period, the coefficient of A is 65% and not different from 100% at the 90% confidence level. The coefficient of YNG, public source nonwage income, is 13% in Seattle, 31% in Denver 1970, and 23% in Denver 1971. The Seattle and Denver 1970 values are nonzero at the 95% level of confidence, but far from the statutory value of 100%. The Denver 1971 coefficient is not statistically different from zero, but is significantly different from 100% at the 95% confidence level. Except in Denver 1970, statistical evidence upon which to base a conclusion about private source nonwage income is lacking. However, it is highly unlikely that this component is better captured than public source nonwage income. We can conclude that alimony is the only component of nonwage income which is well captured by the AFDC program. All other private source nonwage income and most public source nonwage income escapes AFDC taxation altogether.

The coefficient of EM, AFDC taxable earnings of the male head, are all close to 5%. The coefficient of EMH in Denver 1971 sample drops from significance at the 95% level at 4.2%. (It is significant at the 90% level; the other two are significant at the 95% level.) Five percent is far below the minimum statutory tax rate of between 36% and 43%, due to the combined effect of many male heads being outside the AFDC family altogether, and the likely relatively poorer reporting of male head earnings to AFDC. The coefficient of EFH, taxable earnings of the female head, is 25% in Seattle and statistically significantly different both from zero and also significantly below the statutory minimum of 36%. Because all families in our AFDC sample have a female head, the lower measured tax rate is due to the underreporting of female-head earnings. The coefficients of EFH in Denver are about 21% with a standard error of 3%, considerably less than in Seattle, and even further from the statutory minimum tax rate of 43%. Adding the square of EFH to the regression alters the marginal tax rate estimate to:

$$\alpha_1 + 2\alpha_2 EFH \quad , \tag{18}$$

where α_1 is the coefficient of EFH and α_2 is the coefficient of EFH^2. From the discussion above, we expect the coefficient α_1 to increase, and the coefficient α_2 to be negative when EFH^2 is added to the regression. Furthermore, since EFH and EFH^2 are highly colinear, we expect relatively large standard errors in the estimates of α_1 and α_2. In Seattle, the coefficient of α_1 is 22% (a decrease of 3.5%) with a standard error of 5%. α_2 is 7×10^{-5} with a standard error of 10×10^{-5}. An increasing tax rate of 1.4% per hundred dollars of earnings of the female head is weakly implied. This effect is both contrary to our a priori notion and too small an effect to be statistically significant. In Denver in 1970, α_1 is 25% and α_2 is -12×15^5. In Denver in 1971, α_1 is 32% and α_2 is -21×10^{-5}. These estimates are in accord with our a priori notion of a declining AFDC tax rate, but again, small sample size and high co-linearity between EFH and EFH^2 prevent the estimates from being statistically different from the linear estimates.

The coefficient of EO, taxable earnings of other family members, exhibits a marked difference between Seattle and Denver. The Seattle coefficient is 13% and statistically significantly different from zero at the 95% confidence level, while the Denver coefficients are 4% and -4% and not statistically significant. This result is in agreement with the greater consistency between the SIME family and the Seattle AFDC family previously indicated by the support level regressions. Some of the divergence between the tax rate on female-head earnings and that on earnings of other family members probably has to do with the fact that much of the earnings of older teenage family members is not taxable by AFDC because many teenagers are students not working full time. In Denver, however, relatively more teenage DIME family members appear to be outside the AFDC support group, in which case their earnings are not taxable by AFDC whether or not they work full time. Nonhead family members older than 20 appear to be outside the AFDC family altogether in Denver, while a large fraction of such SIME family members are receiving AFDC support.

One difficulty with the above analysis lies in the fact that many male heads and nonheads appear to be outside the AFDC family. To the (likely) extent that their income is positive, we may have included female heads in our taxable income sample who are not, in fact, taxed by AFDC, because their earnings are lower than E_b and AFDC does not detect or recognize the earnings of the excluded family members. We can correct for this possible source of bias by reestimating the regressions over the entire AFDC samples, and allowing the coefficient of earnings of the female head to have different values above and below E_b, regardless of the magnitude of the earnings of the male head or other family members. These regressions are presented in Tables 11 and 12. This change makes negligible difference to the coefficients of the female-head variables in the Denver regressions, but it reduces the rate of increase in the Seattle tax rate by about half and increases the coefficient of the linear term from 22% to 25% in the nonlinear version.

Conclusions

We conclude that the expected marginal tax rates on earned income are far lower than the statutory reduced form marginal tax rates, and a fortiori lower than the structural form marginal tax rate of 67% often quoted. This is so because of the failure of the AFDC program to capture much of the income which accrues to the economic family unit. There are two major reasons for this shortfall. First, the AFDC taxation unit is not defined on the assumption that all family heads and dependent children are treated equally within the family. An adult may be responsible for the care of some of the children while the other head does not share this responsibility, and some children within the family may be needy while others are not. This AFDC position, while economically unsound, is practical. It is based upon the fact that while economic family units which benefit from scale economies can be formed and dissolved rapidly, the social cost of determining when such units exist is extremely high. The infamous "man in the house" rule of the 1960s, under which it was presumed that any man found in the dwelling after dark was a parent and therefore within the AFDC taxation or eligibility

Table 11

AFDC REGRESSIONS ALL INCOME - LINEAR
(Standard Errors in Parentheses)

Dependent Variable	Statutory Value	Seattle 1970, 1971 Estimated Tax	Denver 1970 Estimated Tax	Denver 1971 Estimated Tax
Independent Variable				
C, constant	0.00	7.337	3.998 (2.333)	1.673
YNP, private source nonwage income	1.00	-.059 (.197)	-.008 (.008)	-.309 (.361)
A, alimony	1.00	.601** (.071)	.409** (.117)	.869** (.146)
YNG, public source nonwage income	1.00	.245** (.028)	.245** (.057)	.345** (.069)
EMH, earnings male head	>.40	.025 (.017)	.012 (.012)	.021 (.016)
EFH1, earnings female head $< E_b$	0.00	.121 (.379)	.024 (.122)	-.241 (.196)
EFH2, earnings female head $> E_b$	>.40	.270** (.025)	.194** (.030)	.210** (.036)
EFD, dummy variable	0.00	-11.925 (14.043)	-1.434 (11.032)	24.55 (16.68)
EO, earnings of other family members	>.40	.085* (.042)	.017 (.028)	-.065 (.041)
σ		48.768	44.848	41.933
R^2		.321	.165	.369
N		791	678	318
$\bar{Y}$		26.684	15.928	22.340

Note E_b = $35 in Seattle, $81 in Denver

* Significantly different from zero at the 95% level of confidence
** Significantly different from zero at the 99% level of confidence

Table 12

AFDC REGRESSIONS ALL INCOME - DECLINING RATE
(Standard Errors in Parentheses)

Dependent Variable	Statutory Value	Seattle 1970, 1971 Estimated Tax	Denver 1970 Estimated Tax	Denver 1971 Estimated Tax
Independent Variable				
C, constant	0.00	7.332	3.991 (2.334)	1.759
YNP, private source nonwage income	1.00	-.061 (.197)	-.008 (.009)	-.293 (.361)
A, alimony	1.00	.602** (.071)	.411** (.117)	.858** (.146)
YNG, public source nonwage income	1.00	.246** (.028)	.246** (.057)	.338** (.069)
EMH, earnings male head	>.40	.025 (.017)	.021 (.012)	.020 (.016)
EFH1, earnings female head $< E_b$	0.00	.121 (.379)	.042 (.122)	-.241 (.196)
EFH2, earnings female head $> E_b$	>.50	.250** (.066)	.250** (.079)	.331** (.116)
$EFH2^2$, square of earnings female head $> E_b$	<-.0002	.00004 (.00011)	-.00014 (.00018)	-.00031 (.00028)
EFD, dummy variable	0.00	-10.362 (15.198)	-5.302 (12.107)	16.647 (18.162)
EO, earnings of other family members	>.40	.084* (.043)	.016 (.029)	-.061 (.041)
σ		48.796	44.86	41.919
R^2		.321	.166	.372
N		791	678	318
$\bar{Y}$		26.684	15.928	22.340

Note E_b = $35 in Seattle, $81 in Denver

* Significantly different from zero at the 95% level of confidence
** Significantly different from zero at the 99% level of confidence

unit, led to extreme efforts on the part of the families to disguise the relationship between the family heads and to no less extreme efforts on the part of welfare departments to find male heads in residence. As a result, the AFDC program has retreated to a more rigid definition of the AFDC family taxation and support units, based upon biological paternity and formal marriage and child adoption. The other cause of the shortfall in income reported to AFDC is simply that individuals clearly within the AFDC taxation unit do not report all their income. This is not surprising in view of the fact that the federal tax system, for example, has found it desirable to institute direct employer reporting of wages and salaries and direct bank and brokerage house reporting of interest and dividends.

The expected AFDC marginal tax rate on the earnings of the male head is approximately 5% in both Seattle and Denver. The marginal tax rate on earnings of the female head is not significantly different from zero up to $35 per month in Seattle and $81 per month in Denver. Above $35 in Seattle, the marginal tax rate appears to be a constant 25 to 27%. Above $81 in Denver the marginal tax rate appears to be a slowly declining function of earnings. Marginal tax rates begin at 26% in 1970 and decline 2.4% per hundred dollars of earnings. In 1971 the marginal tax rate begins at 33% and declines 4.1% per hundred dollars of earnings. At the mean values of female head earnings, $170, $190, and $191, in Seattle 1970 and 1971, Denver 1970, and Denver 1971, respectively, the marginal tax rate estimates are 26%, 21%, and 24%. The marginal tax rate on earnings of other members of the family differs between Seattle and Denver, apparently because of the difference in the AFDC program treatments of these individuals mentioned above. In Seattle, nonfamily heads, age ≥ 21 tend to be included in the taxation unit, and bear a 13% marginal tax rate on their earnings. In Denver, they tend to be excluded from the taxation unit and their marginal tax rate is not statistically different from zero.

The total marginal tax rate faced by female heads as a function of earnings, is given in Table 13.

Table 13

TOTAL MARGINAL TAX RATE FOR FEMALE HEADS PARTICIPATING IN THE AFDC PROGRAM*

Seattle		Denver		
Earned Income ($)	1970/71 (%)	Earned Income ($)	1970 (%)	1971 (%)
0-35	5	0-81	5	5
35-300	31	81-300	33	39
300-650	48	300-650	40	39
650-1,000	42	650-1,000	26	19

*Positive tax rates are approximated by 5%, 22%, and 16% in the income ranges $0-$300, $300-$650, $650-$1,000 in Seattle and by 5%, 24%, and 19% in the same ranges in Denver.

IV THE FOOD STAMP PROGRAM

Introduction

The Food Stamp Program was enacted in 1964 with the stated objective of alleviating hunger and malnutrition by permitting low income households to purchase a nutritionally adequate diet.* Administration is by the Food and Nutrition Service of the U.S. Department of Agriculture through state and local welfare offices. Food stamps are coupons with a monetary face value which are purchased by eligible households for an amount less than total value. The purchase price is a function of household income, increasing as income increases. Food stamps are redeemable only for a restricted category of food, essentialy food intended to be prepared at home and excluding alcoholic beverages.† Since they are not legally transferable, the difference between the face value of food stamps and their cost constitutes a grant restricted to the purchase of designated categories of food.

The Food Stamp Program is unrestricted as to family structure. Intact families with or without working members, single adults, childless couples, and groups of unrelated individuals living in a common household can qualify for food stamps. AFDC and certain general assistance recipients are categorically eligible. Other households must pass an assets test and an income test.

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*A secondary objective was to increase the demand for domestically produced food, in an era of food surplus, by supplementing the food purchasing power of low-income households.

†The 1971 amendments to the Food Stamp Program permitted eligible elderly persons to purchase delivered meals with food stamps.

Statutory Food Stamp Tax Function

The food stamp cost, or in Food Stamp Program jargon, the purchase requirement, is determined by a table such as that shown in Table 14. Note that the purchase requirement is zero for net income up to $19.99, one dollar for income between $20.00 and $29.99. Above $29.99 the purchase requirement increases by three dollars for most $10 increments, and by six dollars for most $20 increments. Near the eligibility income limit the rate of increase slows down. An increase in purchase requirement of $3 per $10 of net income is interpreted to mean that a marginal tax of 30% is applied to net income between $30 and a point near the eligibility limit. Deductions of 10% of earnings to a maximum of $30 per month and the deduction of shelter costs above 30% of income net of other deductions causes the marginal tax rate on gross earnings to differ from that on net earnings. The structural form marginal tax rate on gross earnings varies between 27% and 39%.

Major amendments were made to the Food Stamp Program in 1971 and 1973. The 1971 alterations required national standards benefits, allowed eligible elderly people to purchase delivered meals with food stamps, and established work registration requirements. The 1973 amendments made imported food, seeds, and plants for home vegetables gardens eligible for purchase with food stamps; provided for a nationwide Food Stamp Program by July 1, 1974; provided for semiannual adjustment of food stamp coupon allotments and income eligibility standards to reflect changes in the cost of living; gave AFDC recipients the option of having the food stamp purchase requirement withheld from their AFDC grant checks; and required that the value of inkind housing received from employers be included in income for eligibility determination.

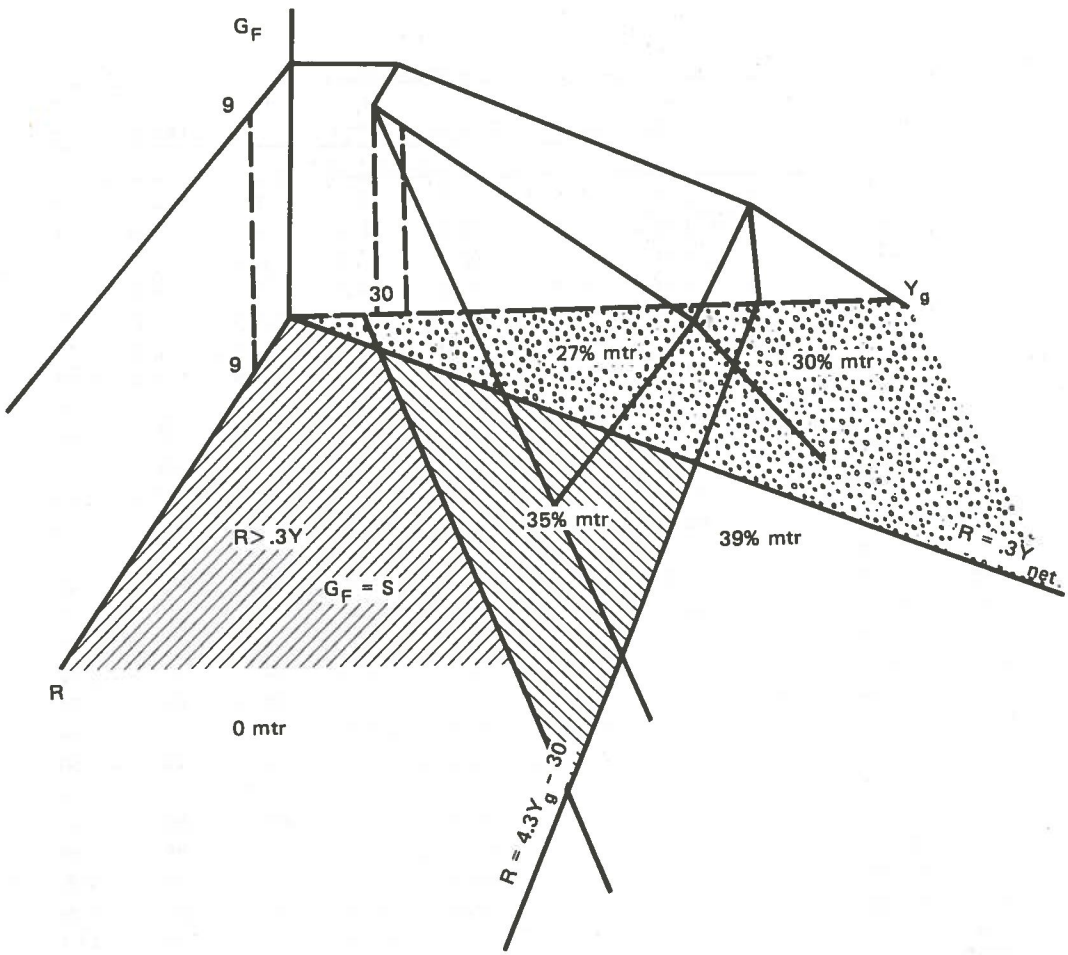
The food stamps grant function is depicted in Figure 2 under the simplifying assumptions that the purchase requirement table can be approximated by a zero tax up to an income of $30 per month, and a constant 30% tax rate on net income thereafter, and that nonwage income is zero. In Figure 2, the food stamps benefit is on the vertical axis, gross earnings on the Y axis, and shelter costs on the R axis. A household

Table 14

MONTHLY COUPON ALLOTMENT AND PURCHASE REQUIREMENT
February 1970

Monthly Net Income	Household Size 1	2	3	4	5	6	7	8
	$28.0	56.0	84.0	106.0	126.0	144.0	162.0	180.0
	Purchase Requirement							
$ 0 - 19.99	.5	1.0	1.5	2.0	2.5	3.0	3.0	3
20 - 29.99	1.0	1.0	1.5	2.0	2.5	3.0	3.0	3
30 - 39.99	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5
40 - 49.99	6.0	7.0	7.0	7.0	8.0	8.0	8.0	9
50 - 59.99	8.0	10.0	10.0	10.0	11.0	11.0	12.0	12
60 - 69.99	10.0	12.0	13.0	13.0	14.0	14.0	15.0	16
70 - 79.99	12.0	15.0	16.0	16.0	17.0	18.0	18.0	19
80 - 89.99	14.0	18.0	19.0	19.0	20.0	21.0	22.0	22
90 - 99.99	16.0	21.0	21.0	22.0	23.0	24.0	25.0	26
100 - 109.99	18.0	23.0	24.0	25.0	26.0	27.0	28.0	29
110 - 119.99		26.0	27.0	28.0	29.0	31.0	32.0	33
120 - 129.99		29.0	30.0	31.0	33.0	34.0	35.0	36
130 - 139.99		31.0	33.0	34.0	36.0	37.0	38.0	40
140 - 149.99		34.0	36.0	37.0	39.0	40.0	42.0	44
150 - 169.99		36.0	40.0	42.0	44.0	46.0	48.0	50
170 - 189.99			46.0	48.0	50.0	52.0	54	56
190 - 209.99			52.0	54.0	56.0	58.0	60	62
210 - 229.99			58.0	60.0	62.0	64.0	66	68
230 - 249.99			64.0	66.0	68.0	70.0	72	74
250 - 269.99			66.0	72.0	74.0	76.0	78	80
270 - 289.99				72.0	80.0	82.0	84	86
290 - 309.99				76.0	84.0	88.0	90	92
310 - 329.99				80.0	84.0	88.0	96	98
330 - 359.99				80.0	88.0	92.0	100	102
360 - 389.99				82.0	92.0	96.0	104	106
390 - 419.99					96.0	100.0	108	110
420 - 449.99					98.0	104.0	112	114
450 - 479.99						108.0	116	118
480 - 509.99						112.0	120	122
510 - 539.99							124	126
540 - 569.99								130
570 - 599.99								134
600 - 629.99								138
630 - 659.99								140

Note: For 9- and 10-person households the costs are the same as for 8-person households for these incomes, save that for incomes from $630-$659.99 the cost is $142. The allotments are $196 and $212, respectively.



mtr = marginal tax rate

FIGURE 2 A SCHEMATIC VIEW OF THE FOOD STAMPS BENEFIT FUNCTION

which pays zero rent will face a zero marginal tax rate up to an income of $33.33, a marginal tax rate of 27% between $33.33 and $300, a marginal tax rate of 30% for income between $300 and the maximum eligibility income limit.* Because the shelter deduction is reduced as income rises, if it is positive to begin with, a rent deduction can face several marginal tax rates. The first effect of the rent deduction is to extend the region of zero taxation beyond $33.33 to the point that $Y_g = (R + 30)/1.3$. Above this income a region of 35% rate is entered. As income exceeds $300, the marginal tax rate increases to 39%. Finally at the point where the shelter deduction is lost (where income net of other deductions exceeds shelter costs divided by 1.3), the marginal tax rate falls to 30%.

Nonwage incomes does not receive the 10% deduction, and is therefore subject to a higher tax rate than is wage income of less than $300. Dropping the restriction of nonwage income to zero, the smoothed food stamp purchase requirement is written

$$T_F = \begin{cases} 0 & \text{if } Y_{Net} < 30 \\ .3(Y_{Net} - 30) & \text{if } Y_{Net} \geq 30 \end{cases} . \qquad (19)$$

The shelter cost deduction is positive only if shelter costs exceed .3 times income net of all other deductions.

$$R_d = \begin{cases} 0 & \text{if } R_d \leq 0 \\ R - .3\left[Y_N - D + \begin{cases} .9E & \text{if } E < 300 \\ E-30 & \text{if } E \geq 300 \end{cases}\right] & \text{if } R_d > 0 \end{cases} . \qquad (20)$$

*This construction ignores deviations from a constant 30% rate on net income which occurs in isolated places throughout the income range and especially near the maximum eligibility limit.

Food Stamps net income becomes

$$\begin{cases} YN + .9E - D & \text{if } E < 300 \text{ and } R < .3Y1 \\ YN + (E-30) - D & \text{if } E \geq 300 \text{ and } R < .3Y1 \\ 1.3YN + 1.17E - 1.3D - R & \text{if } E < 300 \text{ and } R \geq .3Y1 \\ 1.3YN + 1.3(E-30) & \text{if } E \geq 300 \text{ and } R \geq .3Y1 \\ \qquad -1.3D - R \end{cases} \tag{21}$$

Combining Equations (19) and (21) we have the statutory tax function for non-AFDC families,

$$T_F = \begin{cases} 0 & Y_{Net} < 30 \\ .39YN - .39D + .35E - .30R & \text{if } E < 300 \text{ and if } R \geq .30Y1 \\ .30YN - .30D + .27E & \text{if } E < 300 \text{ and if } R < .30Y1 \\ .30YN - .39D + .39(E-30) - .30R & \text{if } E \geq 300 \text{ and if } R \geq .30Y1 \\ .30YN - .30D + .30(E-30) & \text{if } E \geq 300 \text{ and if } R < .30Y1 \end{cases} \tag{22}$$

where the symbols are defined as:

T_F = food stamp purchase requirement

Y_{Net} = net food stamps income

Y_N = nonwage income other than benefits from public assistance programs

E = earned income

D = deductions from earned income - largely tax withholding

R = shelter costs

Y1 = income net of deductions other than rent, $E < 300$

Y2 = income net of deductions other than rent, $E \geq 300$.

Total positive tax withholding rates for a family of four are given in Table 5 in Section III. Combining these tax rates with Equation (22) gives the reduced form marginal tax rates on earned income. For example, a family of four would face the tax marginal tax rates given in Table 15.

Table 15

REDUCED-FORM MARGINAL TAX RATES
FOR NON-AFDC PARTICIPANT FAMILIES IN 1971

Earned Income ($)	Seattle		Denver	
	D* = 0 (%)	D > 0 (%)	D = 0 (%)	D > 0 (%)
100	25	33	25	33
350	24	22	24	21
650	25	23	24	22

*D = rent deduction.

Reduced-Form Tax Function for AFDC Participants

AFDC families face a different reduced form tax function as their AFDC grant is considered an addition to nonwage income by the Food Stamps Program. The interaction of the positive tax system with the AFDC program makes the exact reduced form equation complex, and adds nothing to the specification of the Food Stamp regression function. For our purposes, the AFDC grant function can be approximated by

Table 16

REDUCED-FORM MARGINAL TAX RATES
FOR AFDC PARTICIPANT FAMILIES IN 1971

Earned Income ($)	Seattle		Denver	
	D* = 0 (%)	D > 0 (%)	D = 0 (%)	D > 0 (%)
100	14	21	13	20
350	13	18	12	16
650	14	19	12	17

*D = rent deduction.

Econometric Specification

The reduced form tax functions, Equations (22) and (24), are too complex, even after simplifying assumptions are made. To estimate on our sample, however, they do serve to suggest a regression specification and to suggest the independent variables which should be included. In the regression equation, we allow for a positive tax rate on nonwage income on non-AFDC households and enter the AFDC support level for AFDC households. We allow for different tax rates on earned income between AFDC and non-AFDC families. In the Food Stamps Program, the household can be different from the SIME/DIME definition. We therefore enter the number of family members and a female-headed family dummy to attempt to reflect some of this variation. In addition, the earnings of male and female heads who are living in subsidized housing are entered separately with the suggestion that, while the statutory equations do not suggest different tax rates for this group, income reporting may differ between residents of public housing and the rest of the sample. The sample over which the regression is estimated is that group with net taxable income positive, where net taxable income is defined by Equation (21).

The independent variables in the regressions are:

$$G_A = \begin{cases} 0 & \text{if } E < E_b \\ S - Y_N - t_A(E - E_b) & \text{if } E \geq E_b \end{cases}, \tag{23}$$

where t_A is the statutory reduced form marginal tax on earned income which ranges between .37 and .58 in Seattle and .39 and .62 in Denver. E_b is \$35 in Seattle and \$81 in Denver. G_A enters the Food Stamps tax function in the same way as does Y_N. Therefore we can write the Food Stamps tax function.

$$T_F = \begin{cases} 0 \\ .39S - .39D + (.35 - .39t_A)(E + .39t_A E_b - .30R) \\ .30S - .30D + (.27 - .30t_A)E + .30t_A E_b \\ .39S - .39D + (.39 - .39t_A)E + .39*30 + .39t_A E_b - .30R \\ .30S - .30D \_ (.30 - .30t_A)E + .30*30\ .30t_A E_b \end{cases}, \tag{24}$$

where the conditional statements are the same as those for Equation (22) after the AFDC grant has been included in nonwage income. Choosing the minimum statutory value of t_A of .37 in Seattle and .39 in Denver, we arrive at the marginal tax rates in Table 16. Statutory marginal tax rates for AFDC families are 5 to 13% less than they are for non-AFDC families. The tax rate on the AFDC support level is the same as that on nonwage income for non-AFDC households, but the rate on nonwage income other than the AFDC support level is zero for AFDC families because AFDC taxes such income 100%.

$$S = \begin{cases} 1 \text{ if the household is single headed} \\ 0 \text{ otherwise} \end{cases}$$

NF = number of household members

SW = AFDC support level

YNP_{NA} = nonwage income, private source, non-AFDC households

A_{NA} = alimony received, non-AFDC households

YNC_{NA} = nonwage income, public source, non-AFDC households

EX_{NA} = expenses, largely children, non-AFDC households

RD3 = deductible rent

EMH = male head earnings

EFH = female head earnings

EO = earnings of other household members

EMHA = male head earnings, AFDC households

EFHA = female head earnings, AFDC households

EMHR = male head earnings, public housing households

EFHR = female head earnings, public housing households.

Empirical Findings

The results of OLS estimation of the parameters of the regression equation are shown in Table 17. Separate regressions were estimated for the AFDC participant households and non-AFDC participants in Denver 1970. The coefficients of the earnings of the male and female heads are all less than 3% and all of the wrong sign. Surprisingly, some of these are significantly different from zero, even at the $% level of confidence. The coefficients of the earnings variables for AFDC and Public Housing households are positive in 8 of the 16, and tend to be more significant when positive than when negative, indicating, if anything, a higher tax rate for households on other public assistance than for food stamps only households. Most of the nonwage income

Table 17

FOOD STAMPS REGRESSIONS
(Standard Errors in Parenthesis)

	Seattle 1970, 1971	Denver 1970 Non-AFDC	Denver 1970 AFDC	Denver 1971
Dependent Variable:	Cost of Food Stamps	→	→	→
Independent Variable				
C, constant	-12.985	3.586	-13.244**	-3.916
		(4.561)	(4.781)	
S, single-headed family	15.456**	12.987**	2.184	5.619**
	(1.269)	(3.233)	(1.781)	(1.975)
NF, number in family	9.602**	9.757**	4.682*	11.630**
	(.938)	(.790)	(1.859)	(1.232)
SW, AFDC support level	.076**	--	.234**	.000
	(.026)	--	(.055)	(.034)
YNP_N, nonwage income, non-AFDC	-.202	-.017	-.002	-.066
	(.111)	(.014)	(.003)	(.035)
A_N, alimony, non-AFDC	-.064**	-.109*	-.003	-.100**
	(.016)	(.043)	(.040)	(.025)
YNG_N, nonwage income, non-AFDC	-.015**	-.010	-.043**	.006
	(.005)	(.014)	(.014)	(.013)
EX_N, expenses, non-AFDC	-.005	.037	-.000	.223**
	(.043)	(.053)	(.042)	(.052)
RD3, deductible rent	-.075	-.072	-.172**	.007
	(.055)	(.058)	(.035)	(.093)
EMH, earnings male head	-.007	-.017	--	-.010
	(.003)	(.007)	--	(.007)
EFH, earnings female head	-.012**	-.018	--	-.029**
	(.005)	(.010)	--	(.007)
EO, earnings of other family members	-.022**	-.009	.015	-.014
	(.008)	(.013)	(.014)	(.010)
EMHA, earnings male head, AFDC	.023*	--	.006	-.007*
	(.010)	--	(.007)	(.018)
EFHA, earnings female head, AFDC	.024**	--	.009	.051**
	(.009)	--	(.008)	(.011)
EMHR, earnings male head, public housing	.016*	-.005	-.029	.006
	(.007)	(.016)	(.023)	(.017)
EFHR, earnings female head, public housing	.028**	-.015	.006	.031**
	(.007)	(.018)	(.019)	(.011)
σ	19.153	22.772	15.056	16.22
R^2	.507	.321	.594	.526
N	1537	312	499	518
$\bar{Y}$	50.128	39.591	48.539	43.296

coefficients are very small. A puzzling exception is the relatively large and negative coefficient of alimony received by non-AFDC households. (Alimony received by AFDC households is taxed at rates approaching 100% as seen above.) This tax rate ranges from -6% to -10% (it is .003 when alimony is entered in the AFDC household regression for Denver 1970 as expected) when such income should be positively taxed. This suggests that perhaps female headed households not on AFDC may pay less for food stamps, categorically, than female headed households receiving AFDC support. Another dummy variable, one if single-headed and not on AFDC, might have captured this effect more realistically than the alimony variable alone. The coefficient of the single-headed dummy is positive and significant at the 1% level of confidence, except in the Denver 1970 AFDC regression where most of the sample is single headed. This indicates that single-headed families pay about $15 per month more for food stamps than do dual-headed families. This amount is quite a large fraction of the $40 to $50 a month paid for food stamps by all families. The coefficient of NF, the number of household members, however, is surprisingly large, statistically significant, and may hold the key to understanding the reason behind the generally unsatisfactory results of these regressions.

The coefficient of NF indicates an increase in the cost of food stamps of approximately $100 per family member, other things held equal, and this variable accounts for about .45 of the R^2 of a total R^2 of approximately .50 in Seattle and Denver 1971. In Denver 1970, in the non-AFDC regression, NF accounts for .27 of the total R^2 of .32. A glance at the monthly purchase requirement in Table 14 shows that the cost of food stamps increases by only $1 or $2 per family number, monthly net income held constant, over most of the table. (An exception is the 1 to 3 family size range above an income of $100, however, our sample is distributed with significant density over family sizes of 2 to 7.) The face value of the allotment, however, increases by $16 to $28 per family number. What may have happened is that either the family or the interviewer confused face value, or allotment, with the purchase requirement, or cost. Unfortunately, the question asked for the face value and cost rather than the allotment and purchase requirement. To the extent that this reveral

actually happened, we would expect to see more family size dependence in the "cost of food stamps" variable. As a quick check, the Denver 1970 tax functions were reestimated under the constraint that the average face value of food stamps purchased exceeds the average cost. Since this constraint resulted in a slight alteration of the estimates, we can conclude that the recorded cost exceeds the recorded face value in a few cases. Also, in the 1973 SIME/DIME Validation Study,* the food stamps benefit reported to SIME/DIME was the only nonwage income component for which the amount reported to SIME/DIME appeared to be greater than that obtained from the issuing agency records. Clearly, further investigation of the food stamp data base sources is in order.

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*Halsey, H., B. Murarka, and R. Spiegelman, "The Seattle and Denver Validation Study," unpublished report, June 1976.

V PUBLIC HOUSING PROGRAMS

Introduction

Public housing programs have the stated objective of providing decent, safe, sanitary, low-rent housing and related facilities for low-income families. Housing programs adopt a variety of methods, affecting both the supply of low-rent housing and the demand, which are directed at this goal. The Low Rent Public Housing program currently administered by the Department of Housing and Urban Development (HUD) was established under the U.S. Housing Act of 1937. Under this program, loans and grants are made to local public housing agencies for the acquisition, construction, or leasing of housing. The grants guarantee debt service for agency owned housing and cover the difference between tenant rent and the lease plus agency operating expenses for agency leased housing. The newer HUD 236 Interest Reduction Payments program grants payments to the mortgagee on behalf of the mortgagor which reduces the debt service costs. In both programs the reduced housing costs are passed on to tenants in the form of lower rent. The Section 101 Rent Supplement Program, on the other hand, makes rent supplement payments to the owners of approved housing projects on behalf of low-income tenants. The Section 236 Home-Ownership Assistance for Low Income Families program insures mortgages and makes monthly mortgage subsidy payments to the mortgagee.

Low-income tenant rent charges, or mortgage payments in the case of the HUD 235 program, are generally 20 or 25% of net income, subject to limitations which vary from program to program. In the Low Rent Public Housing program rental charges are fixed by the local housing authorities between 20 and 25% of family adjusted income. In the Section 236 program a basic monthly rental charge is established based on the costs of operating the unit under the hypothetical situation where the mortgage bears a 1% interest rate. A "fair market" rental charge is established under similar circumstances except that the market mortgage interest rate is used. Tenants then pay the basic rental charge, 25% of adjusted income,

or the free market rent, depending on adjusted household income. In the Section 101 Rent Supplement Program, tenants pay 25% of adjusted family income, with the proviso that they must pay at least 30% but no more than 90% of the market rent. Families whose income justifies payment of more than 90% of the market rent may remain in their apartment but must pay the market rent. This provision causes a small discontinuity in the benefit function. The Section 235 Home Ownership Assistance program requires the homeowner to pay the greater of 20% of adjusted family income or the monthly payment covering principle and interest that would be required at an interest rate of 1%.

The tenant rent or mortgagee payments are levied against adjusted income, and the adjustments change from program to program. In the Low Rent Public Housing Program, income deducted from yearly adjusted income includes $300 for each nonhead family member residing in the household under 18 years old; $300 for each nonhead family member 18 or older and disabled, handicapped or who is a full-time student; the income of any family member under 18 or who is a full-time student; the first $300 of the income of a wage-earnings spouse of the head of household; and 5% of gross family income, extraordinary expenses and child care payments. The income accounting period is the prospective year, with the magnitude estimate based on current income and anticipated changes in income. The adjusted income definition is the same for the Section 236 program as for the Low Rent Public Housing Program. Under the Section 101 Rent Supplement program, deductions from income include temporary and extraordinary income, and $300 for each minor child in the family. No deduction from the wages of the spouse is allowed, nor is the blanket 5% deduction allowed. Under the Section 235 Home Ownership Assistance program, deductions from income include $300 for each family member under 21 years of age residing in the dwelling, the income of full-time students and family members under 21 years old, the first $300 of the income of a wage-earning spouse of the head of household, nonrecurring income and extraordinary medical expenses, and 5% of annual gross income of all family members over 21 years old residing in the dwelling.

Eligibility for publicly supported housing programs depends upon family structure, assets, and income. Under the Low Rent Public Housing Program, single individuals are excluded unless they are the remaining member of a previous tenant family, or are disabled, handicapped, displaced, or older than 61. Under the Section 236 program, 10% of the eligible housing units may be occupied by single people under 62 years old who are not otherwise eligible because of handicap. To be eligible for Section 101, housing tenants must be older than 61, handicapped, displaced, occupants of substandard housing, or military personnel on active duty or their spouses. To be eligible for Section 236 Home-Ownership Assistance, a family must consist of two or more related persons, a handicapped individual, or a single person older than 61.

Asset limitations are $2,000 per nonelderly family of adjusted assets in the Section 235, 236, and 101 programs. Adjustments include deductions of $300 per dependent, household furnishings, automobiles and personal effects in the 235 program. Personal effects and household furnishings are deducted in the 101 program. No deductions are allowed in the 236 program. There are no federal asset limitations in the Section 101 program, but guidelines much like those of the Section 101 program are written by local public housing officials.

Income limits are also set by local housing authorities in the Section 101 program and the Low Rent Public Housing Program. In general, applicants must be unable to afford decent, safe, sanitary housing provided at market rates. In the Sections 235 and 236 programs, income, adjusted for family size, must be less than 80% of the median annual income for the area.

The major public housing programs in Denver are the Low Rent Public Housing programs, administered by the Denver Housing Authority (DHA) and the Section 101 Rent Supplement Program, although there is some Section 236 and Section 235 program participation as well. One of the large Section 101 Rent Supplement programs is administered by the Catholic Church through the Archdiocesan Housing Committee, Inc. The Denver Housing Authority program rents units for a rental charge of 20% of income. No deductions are allowed from gross income in determining

rent. The DHA places both upper and lower limits, which depend on family size, on the income of eligible tenants. Tenants whose income exceeds the upper limit may not remain in DHA housing. The minimum admission income is 80% of the maximum income; therefore, tenants of the DHA tend to have a relatively small range of income in any family size. The major public housing programs in Seattle are the Low Rent Public Housing program, administered by the Seattle Housing Authority (SHA) and the Section 101 Rent Supplement program, with some Section 236 and Section 235 participation as in Denver.

Statutory Public Housing Tax Function

In general, the public housing cost, or tax, function looks like that of Figure 3. Y_1 is the net income below which the basic rental or minimum mortgage payment is required, and above which rent is proportional to income. Y_2 is an arbitrary minimum occupancy income such as that set by the Denver Housing Authority, and Y_3 is the net income at which the rent equals the free market rent. The Public Housing tax function is displayed following Figure 3.

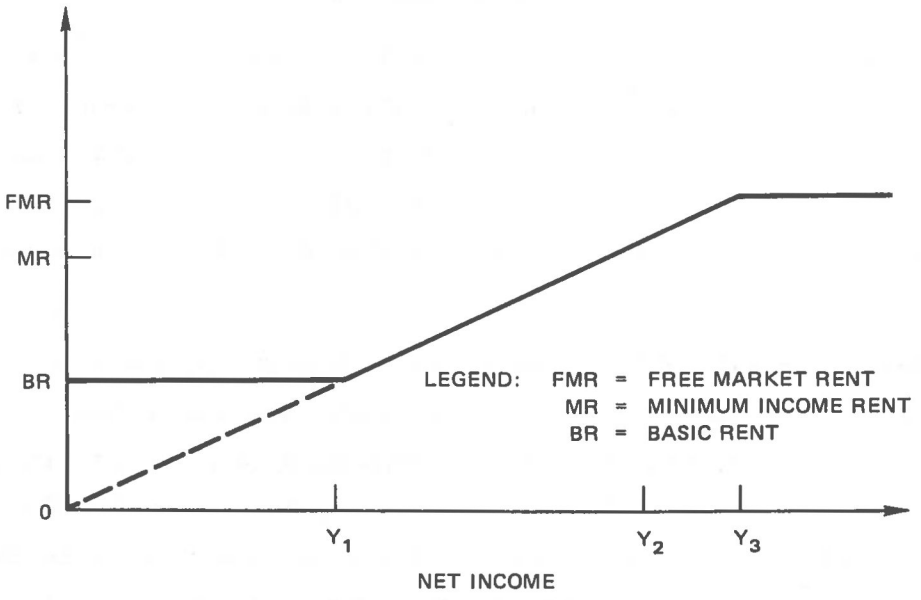

FIGURE 3 PUBLIC HOUSING TAX FUNCTION

$$T_R = \begin{cases} BR & \text{if } Y_{Net} < Y_1, Y_2 \\ .20Y_{Net} & \text{if } Y_1, Y_2 \leq Y_{Net} < Y_3 \\ FMR & \text{if } Y_3 \leq Y_{Net} \end{cases} . \qquad (25)$$

Reduced Form Tax Function for Non-Public Assistance Families

For a household not participating in the AFDC or Food Stamps Programs, the major adjustments to income are the blanket 5% deduction from gross income, and the deduction of $300 per year or $25 per month per dependent. The 5% deduction lowers the marginal tax rate in the region between Y_1 and Y_3 by about 1%. The dependent deduction raises the point at which net income becomes positive by $25 for each dependent. For nonpublic assistance families, net income is

$$Y_{Net} = .95\left(Y_N + E\right) - 25ND \quad , \qquad (26)$$

and the reduced form public housing tax function is

$$T_R = \begin{cases} BR & \text{if } Y_{Net} < Y_b \\ .19\ (Y_N + E) - 5ND & \text{if } Y_b \leq Y_{Net} < Y_3 \\ FMR & \text{if } Y_3 \leq Y_{Net} \end{cases} , \qquad (27)$$

where

Y_N = nonwage income other than the AFDC and Food Stamps grants
E = earned income
ND = the number of public housing dependents
BR = the basic (minimum) rent
Y_b = either Y_1 or Y_2
FMR = the free market rent.

The amount of untaxed gross income can be quite large. Under the Low Rent Public Housing Program, a family of four consisting of two working adults earning $100 each per month and two teenage students each earning $50 per month would exclude $25 per child plus the first $25 of the spouse's income, the $100 earned by the students, and $10 of the gross income of the heads--a total of $185, of a total family monthly income of $300. If the family were receiving an AFDC grant of $150 per month in addition, a further 5% of $150 would be excluded, bringing the total exclusion to $192.50. Total income would be $450 per month and taxable income would be $257.50. Such a family could have lived in a Denver Housing Authority unit, since its yearly income of $5,400 was above the minimum admission income for a family of four of $5,100 and below the maximum continued occupancy income of $6,750.

Reduced Form Tax Function for AFDC and Food Stamps Families

The AFDC grant and Food Stamps benefit are counted in gross income by public housing programs. For families participating in these programs, monthly net income becomes

$$Y_{Net} = .95\left(Y_N + T_A + GF + E\right) - 25ND \quad , \tag{28}$$

where, in addition to symbols defined above,

G_A = AFDC grant
G_F = Food Stamps benefit.

The statutory reduced forms of the AFDC and Food Stamps grant functions are complex [see Equations (17) and (24)] and in full detail add little to the specification of the regression equation. The outline of the reduced form Public Housing tax function can be seen in sufficient detail to properly specify the regression function with the following approximate AFDC and Food Stamps grant functions,

$$G_A = S - Y_N - .36(E - E_b) \tag{29}$$

$$G_F = FV - .30S + .39D - .27E - 24 \quad , \tag{30}$$

where we have chosen the minimum statutory AFDC marginal tax rates (still well above the empirically estimated values) and the branch of the Food Stamps grant function which applies to people whose food stamps net income exceeds .3 times their rent and whose net income is below $300 per month. Under these conditions net income becomes

$$Y_{Net} = .67S + .95FV + .37D + .35E + .34E_b - 22.8 - 25ND \quad , \tag{31}$$

and we can write an approximate reduced form Public Housing tax function for AFDC and Food Stamp participants,

$$T_R = \begin{cases} BR & \text{if } Y_{Net} < Y_0 \\ .13S + .19FV + .07D + .07E & \text{if } Y_b < Y_{Net} < Y_3 \\ FMR & \text{if } Y_3 \leq Y_{Net} \quad . \end{cases} \tag{32}$$

The action of a basic rental charge, or minimum mortgage payment charge, reduces the income range over which a positive marginal tax rate is levied still further. If the minimum payment is $25 the range between Y_1 and Y_2 is $125, meaning that the example family above would not pay the 20% marginal tax on net income below $317.50 per month.

Regression Equation

To estimate the reduced-form public housing tax function, we select the sample of households living in public housing with taxable net incomes by selecting those households for which Y_{Net} is greater than $100 and less than five times our estimate of the free market rent. The $100 minimum taxable income is an approximation to the income needed to exceed Y_1. The free market rent is estimated by

$$FMR = 75 + 15(N - 1) \quad ,$$

where N is the number of family members.

The sample sizes which result from the restriction to net income which is subject to a positive marginal tax rate, are given in Table 18 along with the fractions of the sample which are in the AFDC and Food Stamps programs.

Table 18

SAMPLE SIZES AND PROPORTIONS OF THE PUBLIC HOUSING SAMPLE ON AFDC AND FOOD STAMPS

	Sample Size	AFDC	Food Stamps	AFDC and Food Stamps
Seattle 1970, 1971	585	.44	.71	.39
Denver 1970	176	.32	.42	.23
Denver 1971	112	.46	.50	.33

We wish to estimate a single equation across our entire sample, allowing for differences in marginal tax rates on income between groups participating in different public assistance programs. Therefore, we enter nonwage income divided into our usual three categories, YNP, A, and YNG for the non-AFDC non-Food Stamps group, and separately for the Food Stamps only group. AFDC participants pay no nonwage income Public Housing tax because their nonwage income is 100% taxed (in principle) by the AFDC program. Earned income is entered by program as well as for everyone. The variables entering the regression equation are defined as follows:

S = 1 if the family is single headed, 0 otherwise

NF = number of family members

YNP_N = nonwage income from private sources received by non-AFDC families excluding alimony

A_N = alimony received by non-AFDC families

YNG_N = nonwage income from public sources received by non-AFDC families

EX = expenses, = child care expenses in Seattle and Denver 1971

FV = face value of food stamps purchased

SW = AFDC support level

EMH = earnings of the male head

EFH = earnings of the female head

EO = earnings of the other family members

EMH_A = earnings of the male head in an AFDC family

EFH_A = earnings of the female head in an AFDC family

EMH_F = earnings of the male head in a food stamps family

EMH_F = earnings of the female head in a food stamps family.

The family structure variables, S and NF, account for potential differences between the SIME/DIME family structure and the public housing family structure. The Seattle 1970 and 1971 samples are pooled, and Denver 1970 and 1971 samples are analyzed separately for reasons mentioned above.

Empirical Findings

The results of the regressions are presented in Table 19. The most consistently significant variables are the coefficients of EMH and EFH, which range from 3% to 7% and are significant at at least the 95% level of confidence in all three regressions. Even the largest value, 7%, is considerably below the statutory value of 19%. The coefficients of earned income by Food Stamps and AFDC programs are negative, but not statistically significant in Seattle and in Denver 1970. To the extent that such small coefficients indicate anything at all, they indicate lower marginal tax rates, as the statutory reduced form for households on these programs would suggest. In Denver 1971, however, the coefficient of EFH_A is positive and statistically significant at the 99% level. In combination with the coefficient of EFH a marginal tax rate of 13% is indicated. High Public Housing tax rates for AFDC male heads are also indicated but with lower statistical significance.

Table 19

PUBLIC HOUSING RENT REGRESSIONS
(Standard Errors in Parenthesis)

	Seattle 1970, 1971	Denver 1970	Denver 1971
Dependent Variable	Subsidized Rent →		
Independent Variable			
C, constant	27.658	34.915	44.104
		(11.168)	
S, single-headed family	4.379*	2.623	-10.119
	(2.079)	(5.363)	(6.442)
NF, number in family	-1.280	-3.516	-6.198
	(1.565)	(3.335)	(3.242)
YNP_N, nonwage income, non-AFDC	1.871	.064	.526
	(1.391)	(.134)	(.721)
A_N, alimony, non-AFDC	-.004	-.039	.362**
	(.040)	(.073)	(.149)
YNG_N, nonwage income, non-AFDC	.010	.049	.071
	(.015)	(.036)	(.060)
YNP_F, nonwage income, food stamps	.792	.009	-.054
	(.631)	(1.494)	(.080)
A_F, alimony, food stamps	-.066	.076	-.232
	(.039)	(.121)	(.106)
YNG_F, nonwage income, food stamps	-.006	.135	.214
	(.012)	(.091)	(.128)
EX, expenses	-.018	-.090	-.373**
	(.052)	(.056)	(.159)
FV, food stamps face value	-.041	-.043	.027
	(.026)	(.039)	(.056)
SW, AFDC support level	.124**	.166	.167
	(.042)	(.111)	(.090)
EMH, earnings male head	.056**	.048**	.049**
	(.007)	(.013)	(.020)
EFH, earnings female head	.044**	.029*	.073**
	(.007)	(.014)	(.017)
EO, earnings of other family members	.027	.015	.015
	(.028)	(.042)	(.051)
EMH_A, earnings male head, AFDC	-.035	-.008	.055
	(.018)	(.017)	(.039)
EFH_A, earnings female head, AFDC	.009	.009	.054**
	(.011)	(.019)	(.022)
EMH_F, earnings male head, food stamps	-.017*	-.020	.000
	(.009)	(.015)	(.030)
EFH_F, earnings female head, food stamps	-.005	-.020	-.019
	(.009)	(.020)	(.025)
σ	17.876	19.356	19.895
R^2	.358	.230	.446
N	585	176	112
$\bar{Y}$	62.678	63.250	66.089

* Significantly different from zero at the 95% level of confidence
** Significantly different from zero at the 99% level of confidence

The coefficient of SW, the estimated AFDC support level is 12% and significant at the 99% confidence level in Seattle. In Denver 1970 and 1971, the values are both 17% but not statistically different from zero. These parameter estimates are in close agreement with the statutory value of 13%. A probable explanation is that participation in the AFDC program is well known by landlords and the magnitude of the AFDC support level is well publicized. Since the AFDC grant is inversely related to income, the AFDC recipient cannot report an artificially low grant without implying a high income to the public housing authorities; therefore, the AFDC grant is probably the best known component of income.

The coefficient of FV, the face value of food stamps, is never significant and of the wrong sign in two of the three regressions. This coefficient reflects both the relative ease with which the Food Stamps benefit can be hidden and the fact that we are using SIME/DIME data here which is not as accurate as the welfare department AFDC data, nor has it been reedited as was the SIME/DIME Public Housing shelter cost data.

Most of the coefficients of nonwage income are insignificant. The exception is the 36% coefficient of A_N, alimony received by non-AFDC, non-Food Stamps families in Denver 1970. As large as this coefficient is, it is not statistically different from the statutory value of .19%.

Conclusions

The Public Housing Rent tax functions continue the pattern found in the AFDC and Food Stamps empirical tax functions of low but statistically significant marginal tax rates on earnings and large variances on the nonwage income coefficients. The 5% marginal tax rate on earned income is about one-fourth the statutory value of 19% for non-AFDC, non-Food Stamps families, but is not far from the 7% of the approximate statutory reduced form tax function for AFDC families. The total marginal tax rate for female-headed families is shown in Table 20.

Table 20

TOTAL MARGINAL TAX RATES FOR FEMALE HEADS OF PUBLIC HOUSING FAMILIES

	Seattle		Denver		
	Earned Income ($)	1970/ 1971 (%)	Earned Income ($)	1970 (%)	1971 (%)
Non-AFDC	0-300	9.4		7.9	12.3
	300-650	26.4		26.9	31.3
	650-1,000	20.4		21.9	26.3
AFDC participants	0-35	9.4	0-81	7.9	17.7
	35-300	35.4	81-300	32.9	65.7
	300-650	54.4	300-650	51.9	51.7
	650-1,000	49.4	650-1,000	46.9	33.7

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