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CHAPTER 4

On the Comparison of Income Redistribution Plans

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In this paper, we develop a microsimulation to assess the distributional consequences of the existing system of taxes and transfers and to compare those consequences with the impacts of several alternative credit income-tax systems for the 1970 population and income distributions. Then we use this microsimulation to explore the properties of proportional tax schedules combined with lump-sum credits as a simple form of redistribution that can be used as a reference standard against which other redistributive mechanisms can be assessed.

Our analysis begins with a concept we call "primary" income, which is the money income accruing to families and individuals from their current productive activities and other private transactions. Tax and transfer systems modify this primary income to produce what we call "final" income, which measures the claims of individuals and families on resources. Our analysis examines a variety of final income distributions. Any tax and transfer system redistributes some of the gross revenue it raises, using the rest (the *net* revenue) to finance the direct expenditure programs of the public sector (defense, education, highways, and so on) in combination with other public revenue sources. The alternative systems we specify can be considered comparable to the status quo in the sense that we require them to raise the same net revenue as the current system. Within this constraint, we make drastic alterations in the present system by imagining that almost

all the current programs–Social Security taxes and benefits, public assistance, federal individual income tax, state and local income, sales, and property taxes–are replaced simultaneously by one simplified credit income tax operating on a comprehensive tax base.[1] In doing this, we give no recognition to political or administrative constraints that would make the realization of such a scheme impossible or unwise. We also make no allowance for possible changes in the distribution of primary income due to the level or nature of redistributive activities, although the greater the deviations from the current system, the more likely such changes would be.

Before we proceed with our analysis we would like to consider briefly the "cost" of redistribution–a concept given prominence by discussions of the welfare reform plans introduced during President Nixon's first term. There is no concept of cost obviously appropriate for application to income redistribution questions. If we had a social-welfare function in which we and you really believed, we could simply maximize it with respect to the income distribution and would not need a notion of cost. This question is considered further below. Since we do not have such a function, concepts of cost must be considered. At one extreme, there is a strong a priori basis for expecting total output to be sensitive to the level and type of redistribution; the change in total output is one concept of cost that appeals to an economist. For non-marginal changes, however, the measurement of real output changes is difficult. Labor-supply elasticities of various kinds are required, and lack of firm estimates of such magnitudes has motivated negative-income-tax experiments in New Jersey and elsewhere. At the other extreme, the cost might be reckoned as simply the total dollar amount the Treasury would be obliged to write checks for in a given year. This "Treasury-throughput" measure of cost has some appeal because of its concreteness and its bearing on the extent of redistribution, but it has the disadvantage of making a program paying out gross benefits that are then partially taxed away appear spuriously costly relative to one which pays only net benefits and collects only net taxes. It is, thus, of little interest or relevance except as it bears upon the cost of administration, i.e., how many bureaucrats, clerks, machines,

[1] We have left in place some public transfer programs which are not primarily redistributive in nature but have made the receipts taxable.

lawyers, and accountants would be engaged in the mechanics—paper work and legal work—connected with the system. This notion of administrative costs, though not the subject of this paper, is certainly legitimate and the amount involved may be significant.

Insofar as the administrative and output costs are ignored, a zero sum redistribution, by definition, gives to one group the same number of dollars that it takes from another. The group of households as a whole has the same amount as before to spend on shoes, and ships, and sealing wax. An individual taxpayer, of course, has a great deal of interest in how much redistribution is going to cost him; this depends on his particular circumstances and may be a negative amount. It is possible to make some sense out of the cost question if one defines a specific group of families, e.g., those with red hair or, more relevantly, those with high incomes, and then asks how a specified change in redistribution policy affects their net tax bill.

The question of how much a particular redistribution costs, then, can only be answered either (1) by discussing the imponderables involved in foregone output or changed administrative costs; or (2) by asking for clarification as to *whose* cost you are interested in, a rich man's or a poor man's. We take a rather different approach to the issue of producing one statistic that defines a group of tax-and-transfer schemes with comparable impact on the income distribution for the entire population. Rather than calculating either of these notions of cost, we compare redistributions on the basis of the fraction of personal income explicitly intended for redistribution, i.e., distributed on a basis without regard to income. This share of income may be distributed, as in a credit income tax,[2] on a per capita basis; or according to schedules based on personal and family demographic characteristics. The balance of individual or family income, of course, is either extracted as net revenue for public uses or left in the hands of the people who received it under the primary distribution. Under certain administrative arrangements, this figure could be the same as the Treasury-throughput concept mentioned above.

[2] The credit income tax was proposed by Earl Rolph, "The Case for a Negative Income Tax Device" [15]. See also James Tobin, "Raising the Incomes of the Poor" [18].

FRAMEWORK FOR ANALYSIS

The underlying theme of this paper is the need for better understanding and wider discussion of distributional issues and policies. For this, a better framework of analysis and more explicit standards of comparison than those presently in use would be valuable. While we are convinced that such a framework, or standard, necessarily involves normative judgments, we do not believe that broad concurrence in a minimal set of judgments is impossible. We have, therefore, utilized a redistributional device which, in our view, falls within many people's definition of *fairness*—a simple credit income tax, consisting of a lump-sum grant and a tax schedule linear in income—as a standard form of taxation against which actual systems of taxes and transfers or specific variations can be compared.

The first part of the mechanism is a flat-rate proportional tax. This has a superficial evenhandedness, since it is neither progressive nor regressive and can be derived from the application of the principle of equal sacrifice applied to a utility function that is proportional to the logarithm of income: the Bernouilli assumption about utility. Although there seems to exist a general acceptance of the idea of progressive taxation, we have chosen the proportional rule as a minimum standard of fairness in the belief that virtually no one would seriously press the merits of a less-than-proportional (regressive) formula. However, we have not considered here the question of what kinds of income should be included in the tax base. The other part of the mechanism is the credits, and here again we have aimed at a principle of equal treatment in absolute terms of all persons or equivalent families, regardless of their level of income. This principle provides, at least, a starting point which may be useful in evaluating alternative plans, even though the definition of an equivalent family is not self-evident. (Note that the redistribution issue is here separated into a debate about principles of taxation and a debate about the actual amount of redistribution which should be effected under such principles.[3]) The resulting tax and transfer system is extremely easy to work with and easy to describe both for analysts and taxpayers. In addition, several authors have recently suggested that linear or nearly linear tax structures may have important optimality properties over a range of assumptions.[4]

[3] See Rawls [14] and Lerner [6].

[4] See Mirrlees [7] and Sheshinski [16].

Nevertheless, this linear tax scheme is capable of substantial amounts of redistribution and with a 100 percent tax is capable of achieving whatever notion of equality is built into the credit plan. Average net taxes can be quite progressive, varying from negative values toward an asymptotic rate equal to the marginal or gross tax rate.

With all these considerations in mind, it is proposed that a linear credit tax using poverty-standard credits be adopted as a "canonical" form of redistribution against which alternatives may be compared. It embodies a simple and easily grasped notion of equity, which need not be regarded as final or optimal or even popular; it is, however, a convenient standard that enables us to focus attention more precisely on the case for and against specific departures from it.

An alternative to comparing redistributions on the basis of the fraction of total income given out via the credit is to measure the total change in an income distribution induced by a redistribution plan with a net revenue of zero as

$$C = \frac{\sum_i \left| Y_{Bi} - Y_{Ai} \right|}{\sum_i \left| Y_{Bi} \right|}$$

where Y_{Bi} is the income of the ith unit before taxes and transfers, and Y_{Ai} is its income afterward. The sum is taken over all units in the population. C does not measure a total cost, but it does reflect the magnitude of the overall redistribution. For a linear tax system, this statistic is directly related to the fraction of the before-tax personal income which is redistributed independently of income. To see this, suppose that the tax system has a constant marginal tax rate, t (applied only to positive incomes), and a constant lump-sum grant, a. Then for Y_{Ai} nonnegative:

$$Y_{Ai} = (1 - t)\, Y_{Bi} + a$$

and

$$\left| Y_{Bi} - Y_{Ai} \right| = \left| tY_{Bi} - a \right|.$$

Since the total net tax is zero, $t = Na \Big/ \sum_{i \in p} Y_{Bi}$, where the population is of size N, and p is the set of indexes of the N_p units

with positive pretax income. Therefore,

$$C = N|a| \left[\sum_{i \epsilon p} \frac{NY_{Bi} - \sum_{i \epsilon p} Y_{Bi}}{\left(\sum_{i \epsilon p} Y_{Bi} \right) \sum_{i=1}^{N} |Y_{Bi}| N} + \frac{N - N_p}{\sum_{i=1}^{N} |Y_{Bi}| N} \right].$$

Since the term in brackets is constant by assumption, C is directly proportional to $|a|$ for any given population. If we had defined C in terms of squared changes instead of their absolute values, C would be proportional to a^2. When the demogrant[5] differs for different population units, however, C and the sum of the grants are not uniquely related to each other. (Constraining two different demogrant systems to have the same value of C as well as to yield zero net revenue is, unfortunately, too expensive a computational task for us.)

The choice of a scale on which to base the credits is crucial. A simple and appealing possibility is to allocate equal credits to all persons. This would be a more satisfactory choice if it were possible to deal realistically with individual lifetime incomes either for statistical analysis or for actual tax administration. In fact, we must deal with income over shorter periods, usually one year, and recognize that the family or household is the smallest unit to which many kinds of income can be allocated. Since families are very diversely constituted, some means to standardize them must be found. Although they have many drawbacks, the poverty thresholds for various sizes and kinds of families represent the most widely used and recognized scale of equivalence. We shall therefore use this scale to normalize family incomes; that is, we shall use the ratio of income to the poverty threshold[6] appropriate for each family, termed the welfare ratio, as the basis for comparing families' needs. This normalization is particularly questionable for high-income families, but in those calculations which assume diminishing marginal utility, inaccuracies in the normalization become less important as income rises. Tax credits

[5] The term demogrant is used here as synonymous with the credit part of a credit income tax. It emphasizes the property that the credits are lump-sum amounts which may be related to demographic and family characteristics but not to income or wealth status.

[6] For a definition and explanation of the current poverty ("low income") thresholds, see *Characteristics of the Low Income Population 1970* [4].

in the standard redistribution are allocated in proportion to these thresholds.

In summary then, we are concerned with the variety of redistributions that are, by assumption, "costless." No allowance is made for output or administrative costs. The question is, simply, who recieves what proportion of a fixed total of final income. We will consider specific population groups, defined both in terms of their demographic characteristics and in terms of their income status. We evaluate the cost to such groups, or the benefits, relative either to the status quo or relative to a zero-redistribution norm. For readers with highly developed a priori notions about an equitable income distribution, the relatively raw and disaggregated distributions of final income for various groups will be the most interesting results. We have attempted, however, to supply several alternative redistributions. For this, we have adopted a group of primitive utility-based inequality measures that can be readily evaluated. These will be shown both in fully aggregated form and with breakdowns which show the impact on various demographic groups and on the poor and nonpoor subpopulations.

First of all, as mentioned before, we use a family income welfare-ratio measure to normalize different family compositions. In the utility analysis, we assume that this ratio is the argument of each person's utility function. Utility can then be suitably aggregated for each family and for groups of families.[7] The class of utility functions and inequality measures we consider, which has been suggested by Atkinson [1], includes a wide range of assumptions about the rate of decline of marginal utility with increases in the welfare index. This class of functions includes as special cases a linear utility function (with constant marginal utility) and a logarithmic function, where marginal utility declines in proportion to the inverse of the welfare index. It also includes measures with more rapidly falling marginal utility, two of which we have used.

Let us now turn to further discussion of the tax base we are using. We refer to this as primary income. In so doing, we are trying to use a term which does not connote close conformity with any of the commonly used income concepts and to signal the possibility that some of our approximations may be inaccurate.

[7] In order to deal with negative and zero incomes we do not allow the argument of the utility function to fall below 0.1.

We are aiming at a concept which measures the flow of income to families and individuals prior to any tampering by the public sector. We cannot, however, undo all the real allocational and distributional consequences of public sector activities, as this would require an elaborate general equilibrium analysis.

For the present calculations, we have used the Current Population Survey (CPS) money income concept as adjusted in the MERGE File to conform to aggregate control totals, minus public transfers from Social Security, public assistance, unemployment insurance benefits, workmen's compensation, and income-conditioned veterans' benefits. To this, we have added realized capital gains. This income concept totals $679 billion for the simulated 1970 population in the MERGE File, which is nearly $125 billion less than total personal income in the national accounts for 1970, both because of the transfer payments that have been deducted and because of various imputations in the national accounts that are not in the MERGE File. We have, however, in our calculations retained those public transfers with the exception of Old-Age, Survivors, and Disability Insurance (OASDI) that are not primarily designed to affect the size distribution of income.

The basic strategy is first to calculate a "final" income based on the status quo of taxes and transfers as they existed in 1970, and then to compare the redistribution effected by those policies with a group of alternative redistributions produced by simple credit-income-tax formulas, which differ from each other in the formula for the credit and in the amount of income redistributed. An attempt has been made to be quite inclusive as regards taxes at all levels. A disproportionate interest is always taken in the federal individual income tax, because it is the largest single tax program affecting households directly and because it is a universal program subject to debate and change at the federal policy level; but other taxes, in the aggregate, constitute a similar proportion of the difference between primary and final income and need to be accounted for in any comprehensive assessment of overall redistribution. Hence, from primary income we have subtracted federal individual income taxes, employee contributions for Social Security, property taxes, state individual income taxes, and sales taxes.[8] Finally, the transfers that were subtracted from CPS

[8] For the assumption made about the incidence of the property tax, see the appendix.

income are added back in. We take no account of the federal corporate income tax in this analysis. Thus we must interpret our status quo final income as the total money receipts–after taxes and transfers–available for spending on goods and services, with prices adjusted for both the elimination of sales taxes and the payment of housing expenses other than the property tax.[9]

This final income must be clearly distinguished from the usual concept of disposable income, which only deducts income and payroll taxes but includes such items as imputed rental income of households; hence, disposable income is the amount available for expenditure on goods and services as actually priced. The rationale for using final instead of disposable income is that states regard property and sales taxes as substitutes for income taxes. So calculated, status quo final income totals $566 billion, which is $113 billion, or 16.6 percent, less than the $679 billion of primary income reckoned for 1970. In other words, the net aggregate effects of current tax and transfer policies–federal, state, and local –are to redistribute income in ways to be discussed below and to extract $113 billion of purchasing power for financing various direct-expenditure programs. Some of these programs, of course, are deliberately redistributive, such as food stamps and housing subsidies. Others, such as education, highways, and national defense, are not, although they have some redistributive effects. However, these are not the subject of our inquiry.

In gross terms, the existing taxes we take account of actually collect $54 billion more than the $113 billion described above, but those dollars are returned to the purchasing power of households in the form of transfers. The simplified credit-tax schemes that we introduce for comparison are treated as complete replacements for this entire tax and transfer system. They have all been calibrated to yield the same $113 billion of net revenue–or (equivalently) to reduce primary income down to the final income of $566 billion–as do the status quo policies. In gross terms, the tax is a simple proportional one applied to primary income as the base. If one were concerned only to raise the required net revenue, leaving the primary relative distribution unaltered–which is a hypothetical policy of zero redistribution–a tax of 16.6 percent on primary income would be sufficient. We vary the level of redistribution from this point by increasing the fraction of

[9] In the alternative redistributions, this results in some overstatement of the final income for owners of rental property who report such income on the 1040 federal form and equivalent understatement for renters.

the gross tax by a given proportion–say, 10 percent–and then distributing the resulting added gross revenue–$68 billion in this case–as refundable tax credits, on a basis which is not a function of income.

In addition to varying the level of redistribution, i.e., the fraction of primary income which is distributed as tax credits, we examine six different credit structures. The plans investigated are summarized in Table 1. The first structure is for tax credits that are proportional to family poverty thresholds. It is assumed that relative "needs" are measured by these thresholds, and that it is, therefore, reasonable to allocate credits against gross taxes in proportion to the needs or responsibilities of the family. This is consistent with the choice of poverty thresholds for normalizing family incomes.

The poverty threshold structure of credits is used with four different levels of redistribution, viz., 10 percent, 20 percent, 30 percent, and 50 percent. As explained above, these imply gross proportional taxes ranging from 26.6 percent to 66.6 percent of primary income. This covers a range from relatively weak to quite drastic redistribution. At one end, 12 percent of final income reflects the uniform distribution of credits and 88 percent reflects the initial distribution of primary income. At the other end, only 40 percent of final income reflects the initial income distribution. The table indicates the fraction of the poverty standard that the four levels of distribution afford. Also indicated are the dollar amounts due the prototypical urban male-headed family of four.

The five other structures used are replicated for only two levels of redistribution: 10 percent and 30 percent. The first of these is a simple per capita demogrant with credits of $341 at the 10 percent level, and $1,022 at the 30 percent level, allocated to each person in a family. Next is a per adult allowance which pays $520 or $1,559 at the two redistribution levels to each person over 18. A simple child allowance was considered as a contrast but was rejected because the adverse effect on aged persons, who are left without Social Security, makes the case uninteresting. Instead we have explored a pair of hybrid plans: At the 10 percent level, the same Social Security benefits as the status quo are paid, and the remainder of the $68 billion is allocated as tax credits equally among all persons under 18. At the 30 percent level of redistribution, Social Security benefits are doubled and again the remaining balance is distributed equally among all children. This

TABLE 1 Alternative Credit Income Taxes

	Tax Rates (percent)			
	26.6	*36.6*	*46.6*	*66.6*
Redistribution rate[a]	10	20	30	50
Credit structures:				
1. Poverty standard (fraction of poverty level)	.319	.637	.956	1.593
Mean amount	$1,266	$2,529	$3,795	$6,324
2. Per capita	$341	–	$1,022	–
3. Per adult	$520	–	$1,559	–
4. Social Security plus child allowances	Current Social Security rates plus $504 per child	–	Double current Social Security rates plus $1,995 per child	–
5. Age scale 1: 65 and over, 18 to 64, 0 to 17	$578:$385:$193	–	$1,734:$1,156:$578	–
6. Age scale 2: 65 and over, 18 to 64, 10 to 17, 0 to 9	$613:$408:$204:$102	–	$1,838:$1,225:$613:$306	–

[a] This rate is measured as the percentage of pretax or primary income devoted to redistribution.

results in child allowances of approximately $500 and $2,000 respectively. The last two plans employ credits that are graduated according to age. In the first instance (age scale 1), the population is divided into aged (65 and over), other adults (18 to 64), and children (17 and under), and these three groups get credits with relative values 3:2:1. In the second instance (age scale 2), four groups are distinguished, including two categories of children: aged 10 to 17 and 0 to 9. The younger children receive only half as much as the older ones. The combination of the six alternative structures with the redistribution level variations results in fourteen tax systems. These variations were chosen to show how the actual distributions of income for the United States would be altered by different levels or degrees of redistributional activity, and to explore the consequences of alternative structures for the tax credits.

THE EFFECT OF ALTERNATIVE REDISTRIBUTIONS ON INCOME SHARES

As mentioned earlier, we have adopted a "welfare-ratio" normalization of income, and hence we do not display the traditional distribution by dollar-income brackets. While this normalization is useful in securing comparability among families of different size, it does not render fully comparable categories of families which are treated as distinct in our existing tax and transfer system. Indeed, there are important differences with regard to the equity of income shares among these categories.

We distinguish, instead, six mutually exclusive and exhaustive groups. Individuals 65 and over form one group, and families headed by an aged person form the second. These two groups together contain nearly 92 percent of all aged persons and relatively few persons under 65. The remaining groups are all headed by nonaged persons. Individuals form the third group, families with female heads form the fourth, and the last two groups are small to moderate-sized male-headed families (2 to 5 persons)[10] and large male-headed families (6 or more). Within these groups, the welfare ratio is more reliable as an indicator of economic or income status. We have chosen these groupings for

[10] This is the modal family: more than 55 percent of all persons live in such families.

several reasons. The aged and female-headed categories are presently recognized as having a differential basis for income support. Individuals of all ages are difficult to compare with families in terms of income needs. Finally, large families are often overlooked in our tendency to focus on the four-person archetype.

Section B of Table 2 displays the distribution of total need, as measured by the poverty thresholds, and the distribution of persons in total and by age status across the six groups listed above. Section A of the same table shows how income is distributed among these groups—both primary income and the fifteen versions of final income. It should be noted here that the status quo redistributed a substantial amount of income to the aged and female-headed categories, most of which is offset by reductions in the shares going to nonaged individuals and male-headed families of small to moderate size. By contrast, the poverty-standard redistribution adds to the shares of all groups except the modal group, which is the only one that now gets a larger share of primary income than its share of (poverty-standard) need. With a poverty-standard credit structure, less is provided to the aged and female-headed units than the status quo up to a level of 30 percent redistribution. None of the structures at the 10 percent level does as well by these categories as does the status quo. They all, however, allocate more to the large families and nonaged individuals. Not surprisingly, the Social-Security-plus-child-allowance plan conforms most closely to the current outcome; it differs mainly in giving more to large male-headed families than is currently the case. Clearly the poverty standard and the age-scaled credits are similar in their impact, and both yield less redistribution from individuals or small families to large families than does a flat per capita credit.

However, we are most directly interested in income redistribution among welfare strata. Table 3 contains the basic outcome in terms of primary- and final-income shares. The first three columns indicate how income is distributed among the lowest 20 percent of the population of persons ranked by the welfare ratio of primary income. This group is approximately equivalent to the poor. The next stratum contain 50 percent of the population and ranges from the near-poor at 110 percent of the poverty level up to the moderately comfortable at 375 percent of poverty. The third group, the top 30 percent, is all above 375 percent of poverty level and ranges from the upper middle class through the superrich. In

TABLE 2 Percent Distribution of Income and Persons Among Subgroups of Units for Alternative Redistributions

		Aged		*Nonaged*			
		Individuals	*Family Heads*	*Individuals*	*Female-Headed Families*	*Male-Headed Families* 2 to 5	6+
Section A:							
Primary income		2.1	8.6	7.2	3.1	65.01	13.1
Final income							
Status quo		3.2	10.5	6.5	4.1	62.5	13.2
Poverty standard	10[a]	2.5	8.8	7.4	3.4	64.5	13.4
	20[a]	3.0	9.0	7.6	3.7	63.0	13.7
	30[a]	3.4	9.3	7.8	4.0	61.5	14.0
	50[a]	4.3	9.8	8.1	4.6	58.5	14.7
Per capita	10[a]	2.3	8.8	6.9	3.4	64.7	13.9
Per adult	10[a]	2.5	9.3	7.2	3.3	64.9	12.8

Social Security + child allowance	10[a]	3.2	10.3	6.7	3.7	62.2	13.9
Age scale 1	10[a]	2.5	9.4	7.0	3.3	64.4	13.4
Age scale 2	10[a]	2.6	9.5	7.1	3.3	64.3	13.2
Per capita	30[a]	2.6	9.2	6.3	4.1	62.1	15.7
Per adult	30[a]	3.2	10.9	7.1	3.7	62.6	12.5
Social Security + child allowance	30[a]	4.1	11.2	5.3	4.9	56.7	17.8
Age scale 1	30[a]	3.4	11.0	6.5	3.8	61.2	14.1
Age scale 2	30[a]	3.5	11.4	6.6	3.8	61.1	13.6
Section B:							
"Need"		5.7	10.8	8.6	5.5	53.6	15.8
Persons		3.3	10.5	4.6	5.8	55.4	20.4
Less than 18		—	1.9	.2	8.1	52.6	37.2
18 to 64		—	5.4	8.3	5.2	67.4	13.7
65 and over		29.4	62.4	—	1.4	5.5	1.3

[a] Redistribution rate. This rate is measured as the percentage of pretax or primary income devoted to redistribution.

TABLE 3 Shares of Primary and Final Income Going to Selected Strata of Units Ranked by Primary Welfare Ratio

(percent)

		Low 20 Percent ($w_o < 1.1$)[a]	*Mid 50 Percent* ($w_o = 1.1$-3.75)	*High 30 Percent* ($w_o > 3.75$)	*Top 5 Percent* ($w_o > 8.3$)	*Aged Individuals and Families* ($w_o < 1.1$)	*Female-Headed Families* ($w_o < 1.1$)	*Male-Headed Families* ($w_o < 1.1$)	*Male-Headed Families* ($w_o = 1.1$-3.75)
Primary income		2.8	34.6	62.5	21.6	0.8	0.3	1.4	27.2
Final income									
Status quo		6.9	35.1	58.0	18.7	3.4	1.0	2.0	26.7
Poverty standard	10[b]	5.0	36.3	58.7	19.7	1.7	0.6	2.1	28.5
	20[b]	7.2	37.9	54.9	17.7	2.7	0.8	2.8	29.4
	30[b]	9.4	39.5	51.1	15.8	3.6	1.1	3.5	30.9
	50[b]	13.8	42.8	43.4	11.8	5.5	1.7	4.8	33.3
Per capita	10[b]	4.8	36.5	58.7	19.6	1.5	0.6	2.2	28.9
Per adult	10[b]	4.9	36.0	59.1	19.8	1.9	0.4	2.0	28.1
Social Security + child allowance	10[b]	6.5	36.1	57.4	19.3	3.0	0.8	2.3	27.9
Age scale 1	10[b]	5.1	36.2	58.7	19.7	2.0	0.5	2.1	28.3
Age scale 2	10[b]	5.1	36.1	58.8	19.7	2.1	0.5	2.0	28.2
Per capita	30[b]	8.8	40.2	51.0	15.7	3.0	1.2	3.9	32.3
Per adult	30[b]	8.9	38.7	52.4	16.3	4.1	0.8	3.1	29.7
Social Security + child allowance	30[b]	12.1	40.3	47.6	14.8	5.2	1.9	4.4	31.8
Age scale 1	30[b]	9.6	39.2	51.2	15.9	4.3	1.0	3.4	30.5
Age scale 2	30[b]	9.6	38.9	51.5	16.0	4.6	0.9	3.3	30.0

[a] w_o is the welfare ratio based on primary income.

[b] Redistribution rate. This rate is measured as the percentage of pretax or primary income devoted to redistribution.

the fourth column, the top 5 percent is shown separately—the lowest income in this group is 8.3 times the poverty level before tax and transfers. The last four columns show several subgroups of these strata—the aged, female-headed families, and male-headed families.

It is important to notice that the status quo redistributes a substantial amount toward the lowest 20 percent of the income distribution. Their share increases from 2.8 percent of primary income to nearly 7.0 percent of final income. This is nearly as much as the 7.2 percent achieved by the poverty-standard credit tax at a 20 percent redistribution level. However, the middle 50 percent, in contrast, receive only 35 percent under the current tax system, as compared with the nearly 38 percent they would get under that same 20 percent linear tax scheme. The extra 3 percent is retained by the highest 30 percent with the top 5 percent getting one-third of the extra. Moreover, as the level of redistribution is increased, the share going to the middle 50 percent continues to increase. Indeed, looking further down to the different tax-credit structures, there is no structure at the 10 percent level which is not noticeably more generous to the middle 50 percent than is our present policy. At given redistribution levels, the Social-Security-plus-child-allowance plans provide the largest gains to the poor, but even here there is no tendency for the extra gains to be at the expense of the middle majority.

If one compares the treatment of aged and female-headed families, it is clear that the poverty-standard law at the 30 percent redistribution rate is most comparable with the status quo. But that law would increase the share going to poor male-headed families from 2 percent to 3.5 percent and raise the transfer going to male-headed families in the middle 50 percent from 26.7 percent to 30.9 percent. This phenomenon is the result of current neglect of the working poor, as well as some squeezing of the lower middle class wage-earning group. The top 30 percent now receive nearly 7 percent more of total final income than they would under this "fair" redistribution. Clearly, the United States already engages in substantial redistribution; and for the groups that are "poorest," the amount is equivalent to a level of nearly 30 percent on a poverty-standard credit tax. However, it is also clear that the male-headed families of modest means have not been given comparable treatment, and that it would not be necessary to penalize the families near the median welfare-ratio level in order to

be more generous–and more uniformly so–to the poor and the near-poor.

Table 4 shows how the distribution of persons by welfare ratio is altered by redistribution. The current policies reduce the fractions below the poverty level and the fraction more than four times above it. The effect of high redistribution levels is to concentrate more and more persons in the 2 to 4 range of the welfare ratio, which includes the mean (2.7). The strongly redistributive poverty-standard law at the 50 percent redistribution rate completely eliminates poverty; it also decimates the stratum above eight times the poverty level and concentrates 70 percent of the population in the 2 to 4 range, which now contains only 35 percent. The Social-Security-plus-child-allowance plans are

TABLE 4 Percent Distribution of Persons by Welfare Ratio of Unit for Alternative Redistributions

		0 to 1	*1 to 2*	*2 to 4*	*4 to 8*	*8+*
Primary income		18.1	21.0	33.9	21.4	5.5
Final income						
Status quo		15.5	31.1	35.3	15.3	2.8
Poverty standard	10[a]	17.1	28.6	37.0	14.8	2.5
	20[a]	11.5	31.0	42.1	13.7	1.7
	30[a]	5.0	33.5	48.5	11.8	1.2
	50[a]	0.0	22.4	70.5	6.6	0.5
Per capita	10[a]	16.3	28.5	37.8	14.9	2.5
Per adult	10[a]	17.8	28.4	36.3	14.9	2.6
Social Security + child allowance	10[a]	14.0	31.2	38.0	14.5	2.3
Age scale 1	10[a]	16.8	29.0	36.8	14.9	2.5
Age scale 2	10[a]	17.0	28.9	36.7	14.8	2.6
Per capita	30[a]	5.7	28.0	52.8	12.3	1.2
Per adult	30[a]	7.8	33.3	44.4	13.1	1.4
Social Security + child allowance	30[a]	5.4	24.1	57.6	11.8	1.1
Age scale 1	30[a]	5.0	32.9	48.6	12.2	1.3
Age scale 2	30[a]	5.4	33.9	46.9	12.5	1.3

[a] Redistribution rate. This rate is measured as the percentage of pretax or primary income devoted to redistribution.

seen here to be the most effective in reducing dispersion at any given level of redistribution.

Figure 1 shows how the distribution of persons as ranked by welfare ratios is altered by redistribution. The cumulative distribution is plotted on log-probability scales (a log-normal distribution would provide a straight line). It is evident here that the status quo system reduces dispersion and poverty; it is also clear that the higher levels of redistribution, 30 percent to 50 percent, produce a noticeable amount of added equalization.

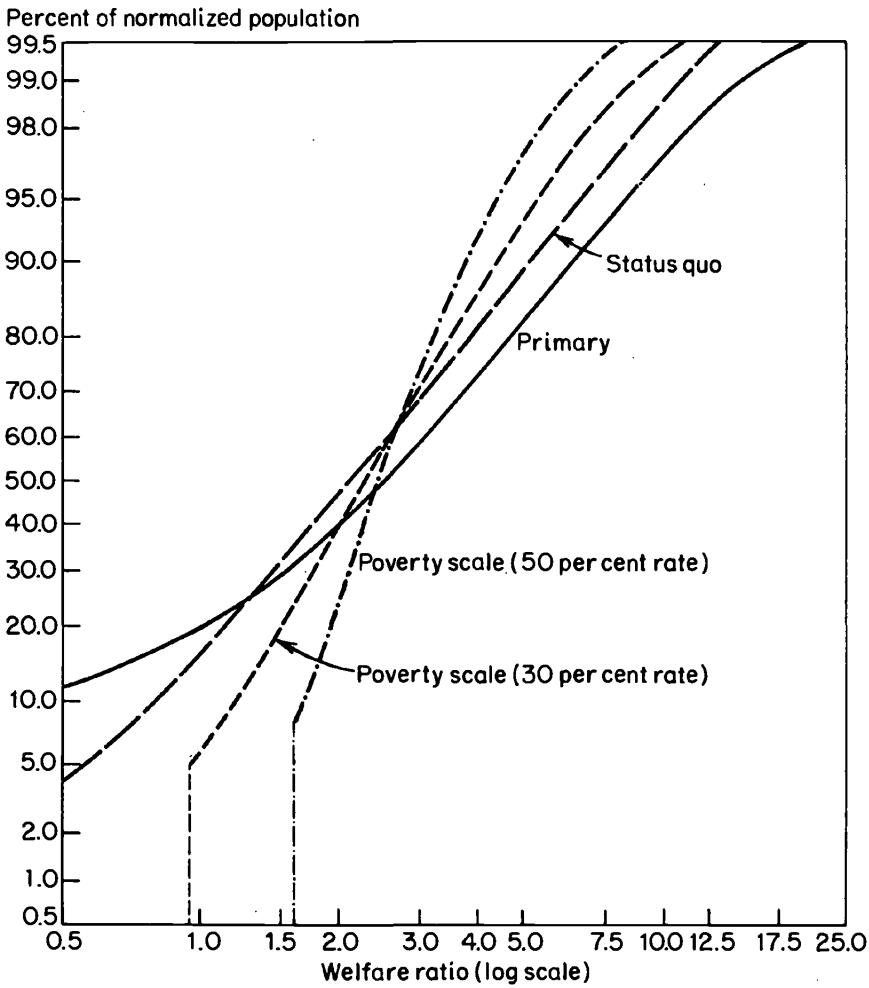

FIGURE 1: Cumulative Distributions of Persons by Welfare Ratio of Family

Figures 2 through 6 display the Lorenz curves for the status quo and various alternative redistributions. Once again we see that current policies do tend to equalize the distribution, and that the alternatives that we have worked with cover a broad range of shift in the curves. It should be repeated here, however, that we have not allowed for any labor-force response by the economy to the tax and transfer system.

ANALYSIS AND RESULTS OF SUMMARY MEASURES OF THE WELFARE DISTRIBUTION

While it is useful, and for many purposes adequate, to observe the impact of redistribution on shares of different groups and

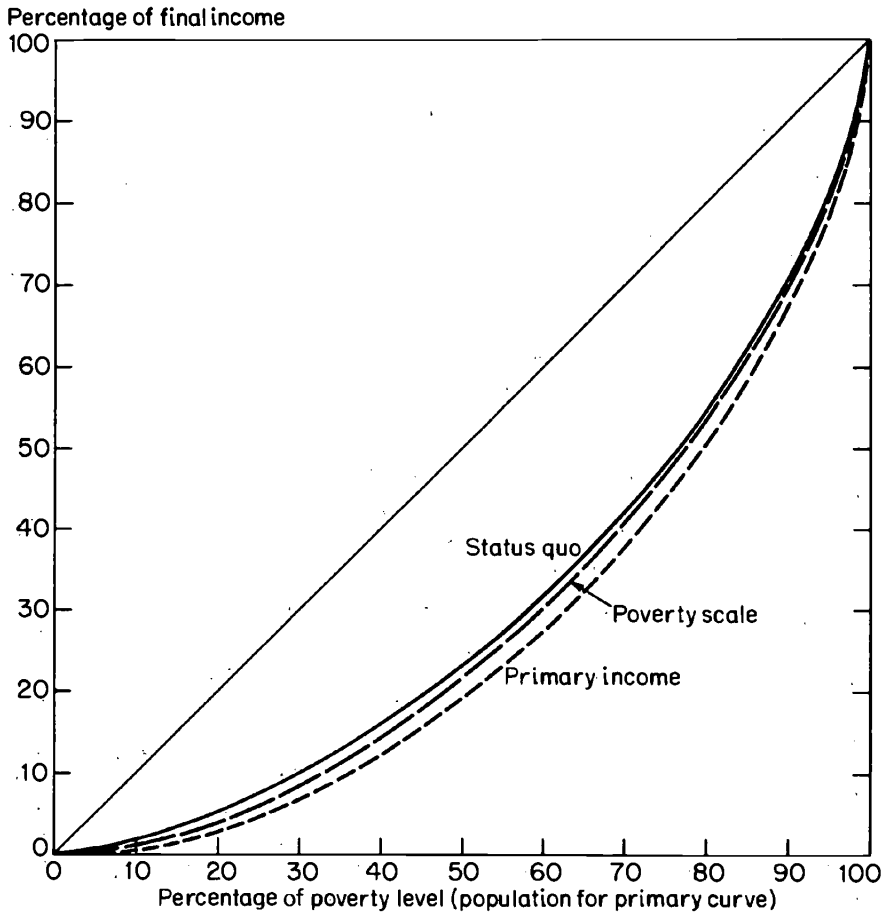

FIGURE 2: Lorenz Curves for Primary Income, Status Quo, and Poverty Scale Redistribution at 10 Percent

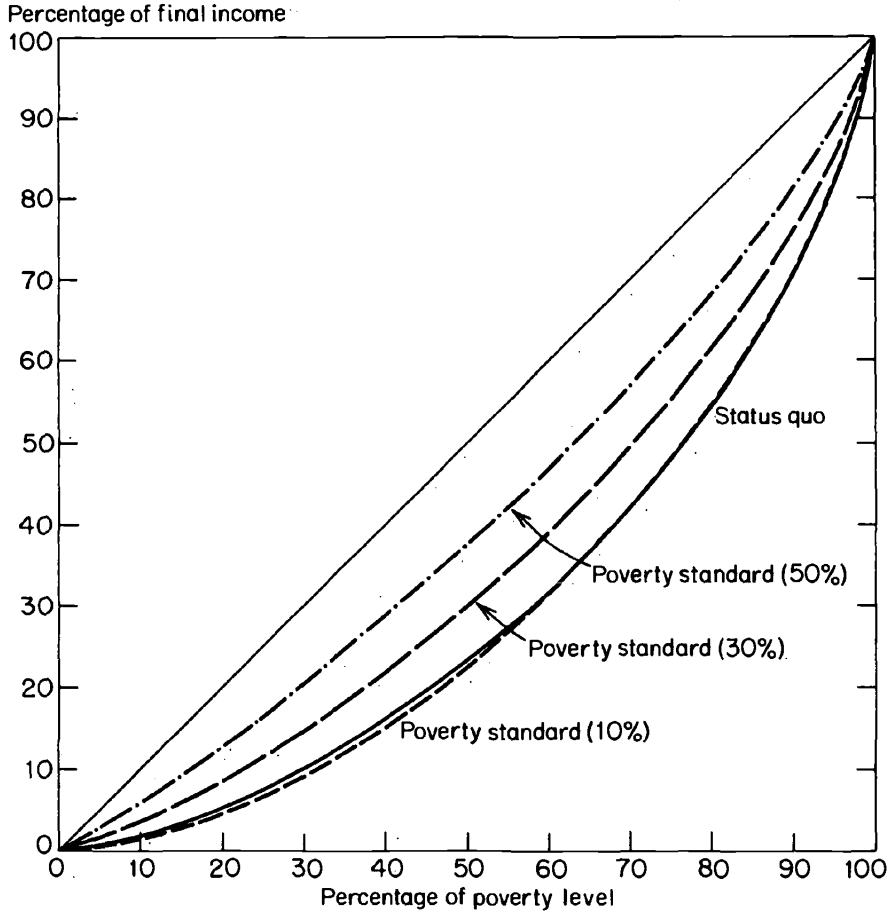

FIGURE 3: Lorenz Curves for Status Quo and Alternative Levels of Redistribution Using Poverty Standard Credits

strata, it is also of interest to evaluate more summary descriptions which attempt to condense the plethora of numbers into a few, more comprehensible indicators. As we view this problem, it is again one of embodying some standard of "fairness" in a formula that enables us to rank and compare final distributions.

The problem of what summary statistics to use in describing an income distribution and what measures of inequality are appropriate is an ancient one. The most commonly used measures are the mean or median income and the Gini coefficient. However, as has been observed, most recently by Atkinson [1] and earlier by Dalton [5], we should be concerned with some notion of social welfare and, therefore, should choose statistics which are directly

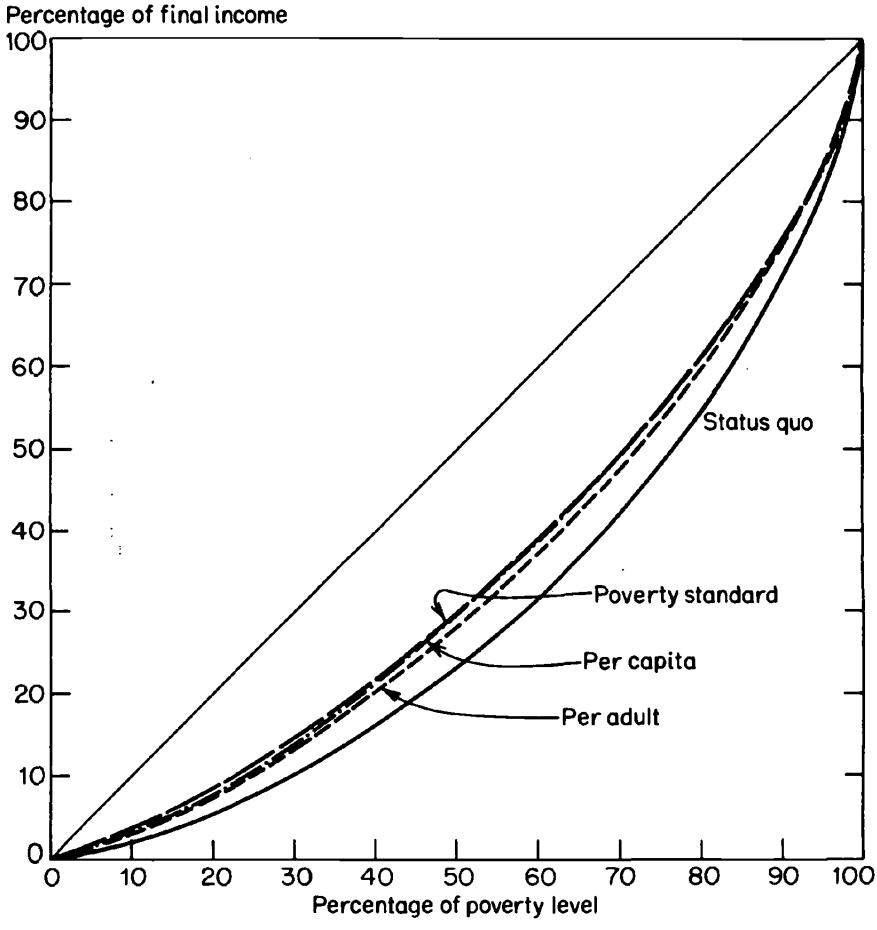

FIGURE 4: Lorenz Curves for Alternative Tax Credit Structures Using 30 Percent Redistribution

related to some social welfare measures. What follows includes a summary of Atkinson's solution to this problem.

Our goal is to rank the alternative income distributions by social welfare. For this purpose, we use a simple social welfare function, W, described below. Many factors which affect social welfare are not taken into account in the formulation we use. Our W might, perhaps, be called a partial social-welfare function to emphasize that other factors are also important. However, we only use W to compare alternative income distributions under ceteris paribus assumptions. It could still be argued that the assumptions about utility and W lead to the omission of important factors which are

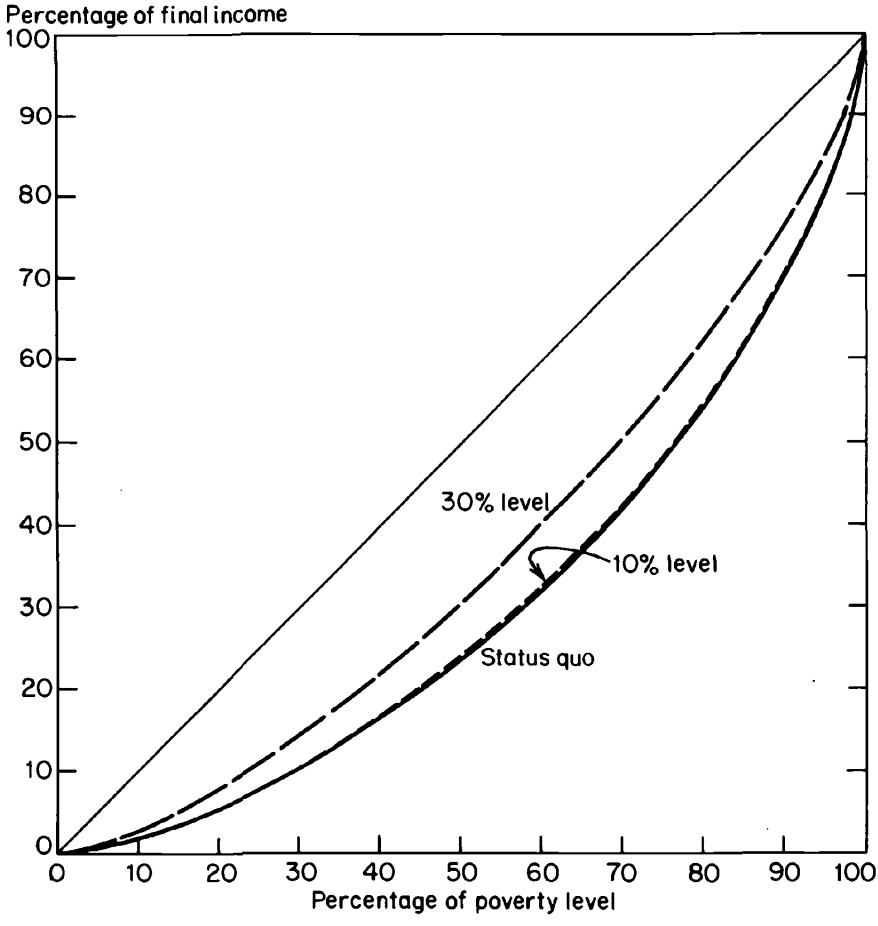

FIGURE 5: Lorenz Curves for Status Quo and Social-Security-Plus-Child-Allowance Plan

not constant as the distribution changes, but we do not pursue more complex formulations. Assume that there exists a social welfare function, W, which is symmetric and additively separable,

$$W = \sum_i U(w_i) f(w_i),$$

where U is the individual utility function which is assumed to be identical for all persons and f is the probability function for the (finite) population. Assume further that the individual utility function, U, is increasing and concave. Under these assumptions two distributions, say f and f^*, with the same mean, can be ranked

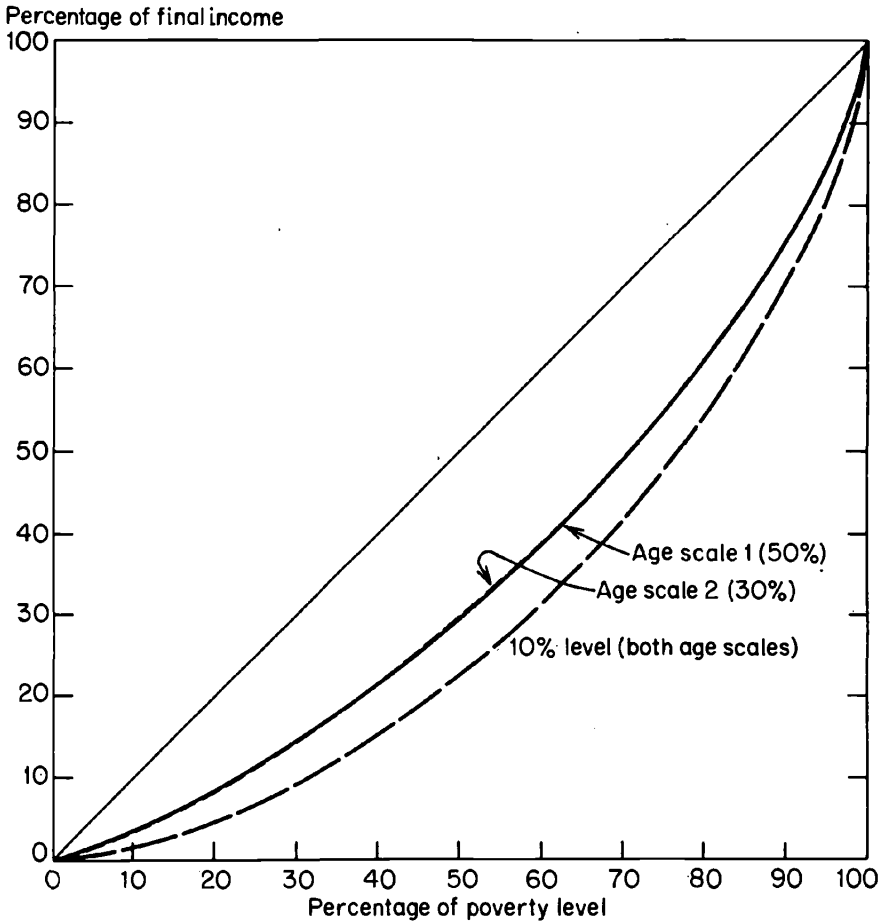

FIGURE 6: Lorenz Curves for Age-Related Plans

without further assumptions about utility functions if, and only if, the two Lorenz curves do not cross. When the means differ, the distribution with the higher mean will be preferred if its Lorenz curve is everywhere above the Lorenz curve of the other distribution.[11]

When the distributions cannot be ranked without further information on the utility function, we choose certain particular functional forms for U which are unique up to a linear

[11] Our exercise might be thought always to result in distributions whose means are equal; however, since we have normalized income by the poverty level, redistributions which preserve the aggregate incomes can change the mean of the welfare ratios.

transformation and have one argument—the family's welfare ratio. Any choice of functions is necessarily subjective. Value judgments must be made sometime, however, and our treatment has the virtue of making these judgments explicit.

Once a utility function is chosen, a measure of inequality can be constructed by analogy with the certainty-equivalent calculations in risk theory.[12] To do this, define the equally distributed-equivalent level of normalized income, w_{ede}, as the per capita amount which would give the same total utility as the actual distribution gives if each person received w_{ede}. That is, $U(w_{ede})$ is the expected value of the utility function over the distribution of w. More formally,

$$U(w_{ede}) = \sum U(w_i) f(w_i).$$

Clearly, w_{ede} depends on the particular utility function chosen. Then the inequality measure defined is $I_U = 1\ (wede/\mu)$, where μ is the mean of the distribution of w. The index I appears similar to a Gini coefficient, because it lies in the interval [0, 1], with zero corresponding to perfect equality, and one, maximum inequality; but, as will be seen below, the index I will generally give a ranking of distributions by inequality different from the Gini coefficient ranking. Under our assumptions about U, social welfare is maximized when all incomes are equal, but we would not assert that complete equality is the ideal distribution. Our analysis is too unrealistic to support such a conclusion, but w_{ede} does suggest an upper bound on the efficiency losses which could be suffered as a consequence of redistribution without producing a decrease in total social welfare.[13]

What reasonable restrictions should be put on the class of possible utility functions? One criterion, suggested by Atkinson and adopted by us, is what he terms "constant relative inequality aversion," i.e., if we transform a distribution by a change of

[12] We also report Gini coefficients, but as Newbery [9] has shown, there exists no additive utility function which ranks distributions in the same order as the Gini coefficient.

[13] It is not obvious that the linear tax systems we investigate are inferior to our current tax system in terms of allocative efficiency. Indeed, this is one of the arguments usually cited in favor of a demogrant system.

location and scale, the inequality measure should not change. This, plus concavity, requires that $U(w)$ be of the form:

$$U(w) = \begin{cases} A + B\dfrac{w^{1-\epsilon}}{1-\epsilon} & \epsilon \neq 1, \\ A + B \ln w & \epsilon = 1. \end{cases}$$

This is a one-parameter family indexed by ϵ, since A and B are arbitrary. When ϵ is zero, marginal utility is constant; as ϵ rises, marginal utility falls more rapidly, $dU/dw = Bw^{-\epsilon}$.

Using this family of utility functions, we are led to the family of inequality measures,

$$I_\epsilon = 1 - \left[\sum \left(\frac{w_i}{\mu}\right)^{1-\epsilon} f(w_i)\right]^{\frac{1}{1-\epsilon}}.$$

These measures are invariant under linear transformations.

We have performed our calculations for four different utility functions corresponding to values for ϵ of 0 (linear), 1 (logarithmic), 1.5 (reciprocal square root), and 2 (reciprocal). Some respondents report negative or zero income. Since we do not believe that this really represents the claims of these units on resources, we have arbitrarily chosen to calculate the welfare ratio as either the reported ratio or .1, whichever is larger. That is, no one is allowed to have a claim on resources of less than 10 percent of his poverty level.[14]

These are individual utility functions, but the argument of the functions is the welfare ratio of the family. To find the utility for a family, individual utility is multiplied by family size. In summary, we (1) assume all persons' utility functions are identical; (2) take some account of economies realized by families living together through the normalization process; (3) assume that there is no inequality within a family; and (4) assume that each family member's utility counts equally in the total welfare of society.

[14] The exact choice of a minimum w is not crucial for the plans we investigate, although a minimum of zero would give very different answers. In the status quo income distribution, only about 1.5 percent of the population report a welfare ratio of less than .1; and in the other distributions, the percentage is also very small. In fact, many of these cases come from families reporting a negative w, and their permanent income is likely to be much larger than the reported amount.

In Table 5, we have assembled several averages and inequality measures describing the various final distributions. The first column contains the average individual welfare ratio, where the individual ratio for a person is equal to the welfare ratio of his family. The next three columns contain the "equally distributed-equivalent" welfare ratios corresponding to ϵ values of 1.0, 1.5, and 2.0, respectively. The first column is, of course, w_{ede} (0). It is worth pointing out that these can be regarded as averages—w_{ede} (1) is simply the geometric mean of individual welfare ratios and w_{ede} (2) is their harmonic mean, while w_{ede} (1.5) is some parametric hybrid average—and we can appeal to theorems about the relative size of these means (applied to positive numbers) to infer that the equivalent income will be smaller, the larger is ϵ for any given distribution. Alternatively, observe that w_{ede} (ϵ) falls as ϵ rises, because the faster marginal utility falls, the greater is the amount of income which can be redistributed away from high-income families for any given utility loss.

Columns 5 through 7 contain the inequality index values for ϵ = 1.0, 1.5, and 2.0. I_0 is identically zero and is, therefore, not shown. As explained above, these values indicate the fraction of current (unequally distributed) income that would be required to achieve the same total utility if distributed equally. Equivalently, it places an upper bound on the income loss that could be "afforded" by a redistribution without lowering average welfare. These values can be readily calculated from the numbers on the left as:

$$I_\epsilon = 1 - \frac{w_{ede}(\epsilon)}{w_{ede}(0)} .$$

Finally, the Gini coefficient is shown in the last column. In comparing our estimates of the Gini coefficients with others in the literature, it must be recalled that the population is measured in units of need. The average utilities have not been shown, but they can be derived by substituting the appropriate w_{ede} into the formula given above.

The means and inequality measures are shown for the overall distribution, separately for the poor and nonpoor ($w < 1$, $w \geq 1$), and for each of the six subgroups of the population. The inequality measures for such subgroups reflect only internal dispersion; between-group dispersion is reflected in the all-unit measures.

TABLE 5 Averages and Inequality Measures From Actual and Transformed Distribution of Welfare Ratios

	Average Welfare	$W_e(1)$	$W_e(1.5)$	$W_e(2.0)$	$I(1.0)$	$I(1.5)$	$I(2.0)$	*Gini Coefficient*
Primary income:								
All	3.23	2.01	1.35	.82	.379	.581	.746	.4601
Poor	.42	.30	.25	.21	.293	.420	.513	.3600
Nonpoor	3.88	3.12	2.85	2.63	.197	.266	.323	.3767
Aged								
Individuals	1.22	.40	.26	.20	.675	.786	.837	.7305
Heads	2.59	1.06	.64	.41	.589	.754	.843	.6249
Nonaged								
Individuals	2.70	1.49	.93	.57	.447	.654	.790	.4943
Female heads	1.73	.74	.45	.30	.570	.742	.827	.6079
Male head 2-5	3.89	2.88	2.32	1.67	.259	.403	.571	.3938
Male head 6+	2.64	1.91	1.51	1.08	.277	.429	.590	.3943
Status quo final income:								
All	2.70	2.00	1.65	1.29	.259	.387	.523	.3957
Poor	.84	.67	.57	.46	.205	.325	.448	.1863
Nonpoor	3.13	2.58	2.37	2.19	.175	.242	.300	.3380
Aged								
Individuals	1.52	1.09	.93	.77	.280	.387	.490	NA
Heads	2.64	1.87	1.59	1.29	.289	.398	.511	NA
Nonaged								
Individuals	2.04	1.36	1.01	.71	.333	.503	.650	NA
Female heads	1.93	1.41	1.19	.97	.270	.387	.497	NA

Male head 2-5	3.09	2.38	2.02	1.58	.229	.348	.489	NA
Male head 6+	2.23	1.71	1.43	1.13	.233	.356	.491	NA
Poverty standard (10)[a]:								
All	2.68	1.96	1.62	1.30	.270	.394	.516	.4088
Poor	.60	.55	.49	.44	.094	.192	.262	.2075
Nonpoor	2.16	2.63	2.48	2.33	.168	.214	.262	.3321
Aged								
Individuals	1.18	.69	.59	.51	.419	.503	.565	.5477
Heads	2.20	1.33	1.02	.83	.395	.537	.621	.5400
Nonaged								
Individuals	2.29	1.60	1.31	1.06	.300	.427	.536	.4243
Female heads	1.58	1.06	.85	.72	.328	.462	.543	.4744
Male head 2-5	3.16	2.50	2.21	1.31	.208	.300	.421	.3462
Male head 6+	2.24	1.79	1.57	1.31	.203	.299	.416	.3338
Poverty standard (20)[a]:								
All	2.67	2.14	1.91	1.64	.197	.286	.387	.3538
Poor	.87	.83	.75	.68	.046	.140	.224	.0815
Nonpoor	3.09	2.67	2.56	2.44	.135	.170	.208	.3074
Aged								
Individuals	1.38	1.03	.95	.89	.258	.309	.356	.4091
Heads	2.26	1.64	1.37	1.21	.274	.393	.467	.4542
Nonaged								
Individuals	2.34	1.85	1.65	1.44	.209	.295	.385	.3587
Female heads	1.73	1.39	1.23	1.13	.194	.291	.349	.3779
Male head 2-5	3.09	2.58	2.36	2.04	.165	.235	.341	.3063
Male head 6+	2.30	1.96	1.79	1.56	.148	.219	.319	.2828

TABLE 5 *(Continued)*

	Average Welfare	$W_e(1)$	$W_e(1.5)$	$W_e(2.0)$	$I(1.0)$	$I(1.5)$	$I(2.0)$	*Gini Coefficient*
Poverty standard (30)[a]:								
All	2.67	2.28	2.11	1.88	.143	.209	.295	.2980
Poor	2.14	1.11	1.00	.89	.029	.124	.224	.0198
Nonpoor	3.02	2.70	2.63	2.54	.105	.129	.159	.2801
Aged								
Individuals	1.58	1.32	1.28	1.23	.163	.190	.220	.3011
Heads	2.32	1.89	1.65	1.49	.187	.290	.359	.3722
Nonaged								
Individuals	2.39	2.04	1.89	1.70	.145	.208	.286	.2964
Female heads	1.88	1.67	1.53	1.46	.112	.185	.222	.2949
Male head 2-5	3.02	2.63	2.47	2.19	.128	.181	.275	.2639
Male head 6+	2.35	2.10	1.98	1.78	.106	.158	.243	.2326
Poverty standard (50)[a]:								
All	2.66	2.48	2.38	2.21	.066	.103	.167	.1844
Poor	1.69	1.66	1.49	1.28	.017	.117	.242	.3261
Nonpoor	2.88	2.72	2.71	2.66	.055	.061	.076	.1831
Aged								
Individuals	1.98	1.86	1.85	1.83	.063	.065	.076	.1470
Heads	2.45	2.28	2.08	1.94	.068	.149	.207	.2199
Nonaged								
Individuals	2.48	2.33	2.25	2.10	.063	.095	.154	.1750
Female heads	2.17	2.12	2.02	2.00	.022	.067	.079	.1578

Male head 2-5	2.88	2.68	2.61	2.41	.067	.094	.161	.1715
Male head 6+	2.46	2.33	2.25	2.06	.052	.084	.163	.1352
Per Capita (10)[a]:								
All	2.70	1.96	1.60	1.25	.272	.405	.537	.4103
Poor	.61	.53	.46	.41	.129	.242	.324	.2419
Nonpoor	3.18	2.66	2.51	2.36	.165	.210	.257	.3306
Aged								
Individuals	1.05	.51	.40	.34	.518	.617	.680	.6093
Heads	2.20	1.33	1.01	.82	.398	.542	.628	.5423
Nonaged								
Individuals	2.14	1.38	1.04	.77	.358	.515	.641	.4526
Female heads	1.61	1.12	.91	.78	.307	.436	.517	.4645
Male head 2-5	3.18	2.52	2.24	1.85	.205	.296	.417	.3439
Male head 6+	2.34	1.91	1.71	1.44	.184	.271	.385	.3200
Per capita (30)[a]:								
All	2.72	2.32	2.12	1.86	.148	.222	.318	.3067
Poor	1.16	1.08	.95	.83	.072	.182	.287	.1136
Nonpoor	3.09	2.77	2.70	2.61	.102	.126	.155	.2712
Aged								
Individuals	1.18	.88	.82	.76	.255	.307	.358	.4007
Heads	2.32	1.88	1.63	1.47	.192	.298	.369	.3793
Nonaged								
Individuals	1.95	1.53	1.36	1.20	.211	.299	.385	.3621
Female heads	1.97	1.78	1.64	1.56	.097	.168	.206	.2805
Male head 2-5	3.06	2.69	2.52	2.24	.123	.176	.270	.2591
Male head 6+	2.65	2.41	2.29	2.05	.090	.136	.226	.2069

TABLE 5 *(Continued)*

	Average Welfare	$W_e(1)$	$W_e(1.5)$	$W_e(2.0)$	*I(1.0)*	*I(1.5)*	*I(2.0)*	*Gini Coefficient*
Per adult (10)[a]:								
All	2.67	1.91	1.55	1.18	.284	.421	.558	.4150
Poor	.58	.50	.43	.38	.134	.252	.341	.2281
Nonpoor	3.16	2.61	2.45	2.30	.174	.223	.273	.3352
Aged								
Individuals	1.15	.64	.54	.46	.443	.532	.594	.5646
Heads	2.33	1.50	1.17	.98	.358	.496	.581	.5148
Nonaged								
Individuals	2.23	1.50	1.18	.90	.327	.471	.596	.4366
Female heads	1.52	.85	.58	.42	.445	.620	.722	.5195
Male head 2-5	3.18	2.50	2.21	1.82	.212	.305	.427	.3492
Male head 6+	2.16	1.67	1.43	1.16	.228	.336	.460	.3552
Per adult (30)[a]:								
All	2.66	2.20	1.97	1.71	.173	.257	.358	.3229
Poor	1.08	.98	.86	.75	.087	.202	.307	.1137
Nonpoor	3.02	2.65	2.55	2.43	.124	.157	.196	.2912
Aged								
Individuals	1.47	1.20	1.15	1.10	.182	.214	.248	.3237
Heads	2.71	2.29	2.00	1.79	.156	.261	.341	.3331
Nonaged								
Individuals	2.20	1.80	1.59	1.32	.182	.277	.401	.3237
Female heads	1.70	1.24	1.02	.86	.269	.403	.492	.4183

Male head 2-5	3.06	2.63	2.45	2.16	.140	.199	.294	.2792
Male head 6+	2.09	1.78	1.64	1.46	.149	.214	.300	.2889
Social Security plus child allowance (10)[a]:								
All	2.69	2.03	1.71	1.36	.244	.363	.495	.3900
Poor	.80	.69	.58	.49	.142	.278	.393	.1981
Nonpoor	3.13	2.61	2.47	2.32	.165	.210	.258	.3303
Aged								
Individuals	1.49	.98	.82	.67	.346	.449	.549	.4710
Heads	2.56	1.81	1.46	1.20	.293	.430	.530	.4579
Nonaged								
Individuals	2.08	1.31	.95	.65	.370	.544	.687	.4559
Female heads	1.75	1.28	1.05	.89	.268	.400	.492	.4294
Male head 2-5	3.06	2.40	2.11	1.72	.214	.310	.438	.3506
Male head 6+	2.35	1.93	1.72	1.44	.178	.267	.389	.3121
Social Security plus child allowance (30)[a]:								
All	2.75	2.34	2.07	1.68	.151	.247	.389	.2911
Poor	1.60	1.29	.99	.72	.192	.383	.553	.2473
Nonpoor	3.02	2.68	2.58	2.45	.112	.146	.189	.2543
Aged								
Individuals	1.88	1.45	1.25	.98	.228	.335	.477	.3379
Heads	2.78	2.33	1.97	1.64	.163	.291	.410	.3267
Nonaged								
Individuals	1.65	1.09	.81	.58	.339	.507	.650	.4274
Female heads	2.42	2.19	1.98	1.78	.093	.182	.262	.2600
Male head 2-5	2.82	2.42	2.21	1.87	.143	.216	.338	.2738
Male head 6+	3.02	2.78	2.62	2.94	.080	.132	.241	.1836

TABLE 5 *(Concluded)*

	Average Welfare	$W_e(1)$	$W_e(1.5)$	$W_e(2.0)$	$I(1.0)$	$I(1.5)$	$I(2.0)$	*Gini Coefficient*
Age scale 1 (10)[a]:								
All	2.68	1.96	1.63	1.29	.269	.394	.518	.4091
Poor	.62	.56	.49	.44	.104	.209	.286	.2121
Nonpoor	2.16	2.63	2.48	2.33	.168	.215	.263	.3333
Aged								
Individuals	1.18	.68	.59	.51	.423	.509	.570	.5509
Heads	2.34	1.53	1.22	1.03	.346	.479	.560	.5082
Nonaged								
Individuals	2.17	1.41	1.07	.80	.350	.505	.630	.4488
Female heads	1.56	1.00	.78	.64	.357	.501	.588	.4895
Male head 2-5	3.16	2.50	2.20	1.82	.210	.302	.424	.3478
Male head 6+	2.25	1.80	1.58	1.32	.202	.297	.412	.3354
Age scale 1 (30)[a]:								
All	2.69	2.29	2.11	1.87	.146	.215	.303	.3028
Poor	1.20	1.13	1.01	.88	.053	.157	.262	.0776
Nonpoor	3.03	2.70	2.62	2.53	.109	.135	.166	.2788
Aged								
Individuals	1.56	1.30	1.26	1.21	.166	.194	.226	.3059
Heads	2.75	2.36	2.09	1.88	.140	.240	.317	.3193
Nonaged								
Individuals	2.01	2.60	1.43	1.25	.202	.288	.375	.3521
Female heads	1.82	1.55	1.39	1.30	.146	.233	.284	.3334

Male head 6+	2.37	2.11	1.99	1.79	.109	.160	.245	.2390
Age scale 2 (10)[a]:								
All	2.68	1.95	1.62	1.28	.271	.397	.522	.4100
Poor	.62	.55	.48	.44	.107	.214	.292	.2122
Nonpoor	3.16	2.62	2.47	2.32	.170	.218	.266	.3344
Aged								
Individuals	1.20	.70	.60	.53	.413	.496	.558	.5430
Heads	2.37	1.56	1.25	1.06	.339	.471	.553	.5031
Nonaged								
Individuals	2.18	1.43	1.10	.83	.345	.496	.620	.4465
Female heads	1.55	.97	.73	.59	.378	.530	.622	.4973
Male head 2-5	3.15	2.49	2.19	1.81	.212	.305	.426	.3494
Male head 6+	2.27	1.76	1.54	1.28	.209	.306	.423	.3411
Age scale 2 (30)[a]:								
All	2.68	2.27	2.08	1.85	.151	.222	.310	.3067
Poor	1.19	1.12	.99	.87	.059	.164	.267	.0924
Nonpoor	3.02	2.68	2.59	2.49	.114	.142	.176	.2831
Aged								
Individuals	1.62	1.36	1.32	1.27	.159	.185	.214	.2953
Heads	2.82	2.44	2.17	1.97	.136	.232	.303	.3123
Nonaged								
Individuals	2.04	1.64	1.47	1.30	.196	.279	.366	.3463
Female heads	1.79	1.48	1.31	1.20	.171	.269	.328	.3551
Male head 2-5	3.00	2.59	2.42	2.14	.136	.193	.286	.2756
Male head 6+	2.30	2.02	1.90	1.70	.119	.174	.258	.2540

NA = not available.

[a] Redistribution rate. This rate is measured as the percentage of pretax or primary income devoted to redistribution.

Figure 7 shows how the overall inequality measures vary with the level of redistribution, that is, the fraction of primary income distributed in proportion to the poverty standard. We note that the three utility-based measures show a curvilinear relation to the level such that successive fractions of redistribution contribute less to reduction of inequality. The Gini coefficient, on the other hand, declines in a linear way. All these measures should converge at zero when the level reaches 83.4 percent, since that fraction plus the net revenue fraction of 16.6 percent exhaust primary income.

The asterisks on the curves of Figure 7 indicate the levels of inequality that characterize the status quo distribution of final income. Thus, our present policies correspond to a redistribution level of approximately 10 to 12 percent.

Table 6 presents the rankings of the several tax-credit structures according to the various inequality measures. The measures have been normalized to make the current law equal 100 percent. Separate rankings are provided for the 10 and 30 percent levels of redistribution, and the inequality relative to the status quo of the primary distribution is shown separately. As can be seen, the choice of an inequality measure does affect the rankings, which also change with the level of redistribution. The Social Security-plus-child-allowance plan ranks first at the linear level and falls to last at the higher level of redistribution for $\epsilon = 2$.

The Gini coefficient, here, as in Figure 7, shows less sensitivity and dispersion with respect to the variations introduced. For example, the primary distribution is only 16 percent worse than the status quo final distribution on the Gini scale, while it is 40 to 50 percent worse by the utility-based measures.

FINAL REMARKS

At the level of a basically arithmetic exercise to see what happens when highly simplified credit-tax redistributions are applied to a relatively comprehensive pretransfer income base, the work reported above requires no further interpretation, but there are also more ambitious objectives lying behind the study. One is to clarify the notion of cost and to supply a framework within which more relevant equivalence classes of households could be identified for comparative analysis. Toward this objective, a linear credit income tax with credits scaled to the poverty standard has

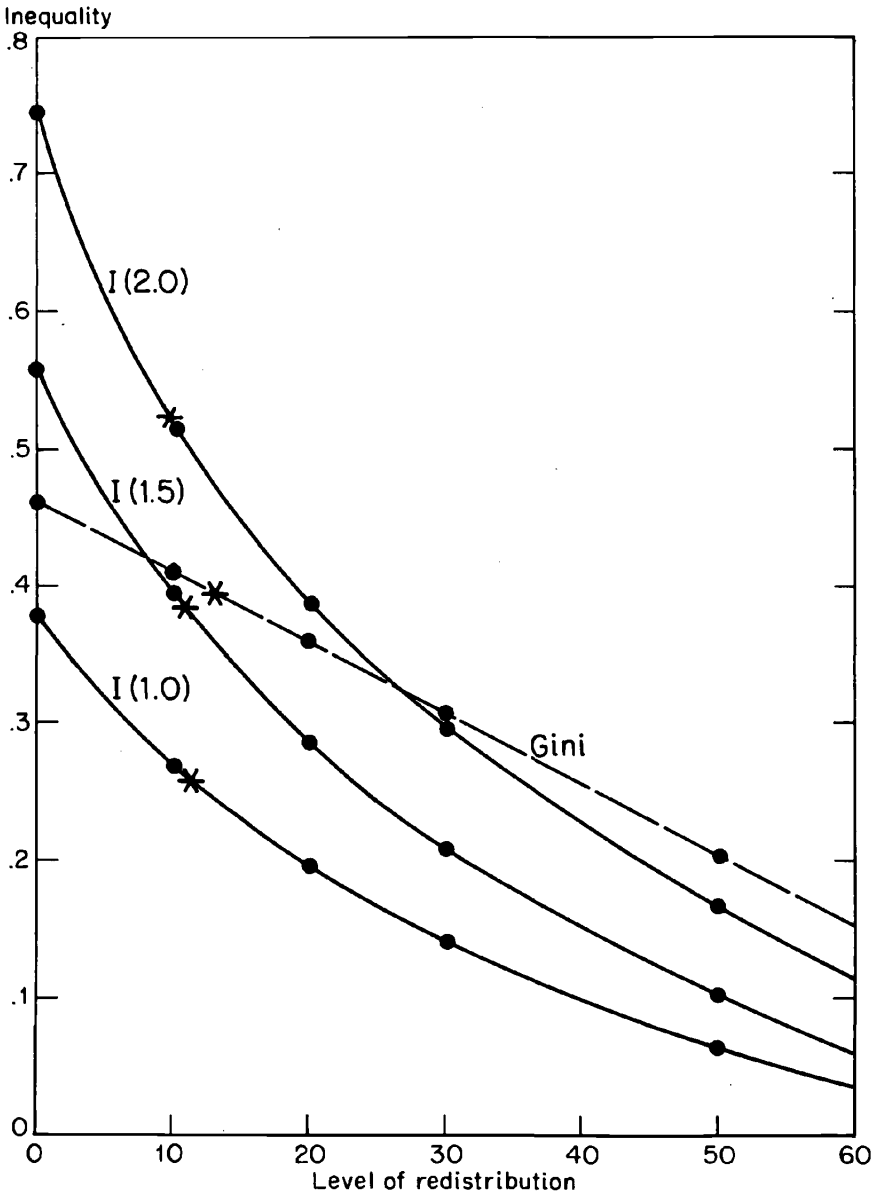

FIGURE 7: Relation Between Inequality Measures and Levels of Redistribution for Poverty-Standard Credits

NOTE: The asterisk denotes level of status quo inequality.

TABLE 6 Ranking of Credit Structures in Relation to Status Quo on the Basis of Alternative Inequality Measures

	Gini Coefficient	I(*1.0*)	I(*1.5*)	I(*2.0*)	
10 percent redistribution:					
Social Security plus child allowance	.99	.94	.94	.95	Social Security plus child allowance
Status quo	1.00	1.00	1.00	.99	Poverty standard
Poverty standard	1.03	1.04	1.02	.99	Age scale 1
Age scale 1	1.03	1.04	1.02	1.00	Age scale 2
Age scale 2	1.04	1.05	1.03	1.00	Status quo
Per capita	1.04	1.05	1.05	1.03	Per capita
Per adult	1.05	1.10	1.09	1.07	Per adult
30 percent redistribution:					
Social Security plus child allowance	.74	.55	.54	.56	Poverty standard
Poverty standard	.75	.57	.56	.58	Age scale 1
Age scale 1	.77	.57	.57	.59	Age scale 2
Per capita	.78	.58	.58	.61	Per capita
Age scale 2	.78	.58	.64	.68	Per adult
Per adult	.82	.67	.66	.74	Social Security plus child allowance
Status quo	1.00	1.00	1.00	1.00	Status quo
No redistribution—same shares as primary income	1.16	1.46	1.50	1.43	

been taken as a reference benchmark. The credit tax is required to generate the same net revenue for nontransfer uses of the public sector and to redistribute a variable fraction of primary income as credits on a uniform basis. The fraction of income so redistributed provides a convenient standardization for comparing alternative credit structures. Equivalence with nonlinear or other more complex structures such as the status quo depends on specifying additional criteria. For example, it was noted that in terms of the various overall indicators of inequality, the status quo corresponds to a credit tax at around 10 to 12 percent redistribution. In terms of the impact on the poor, considered as a homogeneous group, the current law does almost as well as a 20 percent redistribution. Focusing on the aged and female heads, the status quo is more nearly comparable to a 30 percent–say, 27 percent–level of redistribution. By contrast, the allocation to poor male family heads corresponds approximately to a 9 percent redistribution, and the share for male heads in the middle 50 percent category appears to be closer to a 4 to 5 percent redistribution.

Under the assumptions of this paper, the conclusion that relative to the norm provided by the poverty credit tax, the male-headed working poor and lower middle class have been heavily overtaxed or undertransferred is unmistakable. Current benefits are tilted strongly in the direction of the aged and the female-headed; and while one can usually think of reasons why these groups of the poor should be favored over others, it is difficult to find adequate rationalizations for the disparities we find, particularly in view of the large number of children to be found in those male-headed poor and near-poor families. It is also clear that a more active redistributive policy, by moving toward the kind of equity embodied in the credit-tax formula, would not work to the disadvantage of the large middle majority of taxpayers as has often been assumed.

Under the 30 percent poverty-standard plan, the archetypical small family with a male head would enjoy lower taxes up to an income of $11,750; this accounts for 63 percent of such families. Similarly, nearly 70 percent of the larger families with male heads would benefit up to a pretax income of more than $15,500. As indicated before, that plan would allocate more to each of the categories of poor than does the status quo.

These results all assume a strictly proportional gross tax, but it is clear that a more progressive structure for obtaining gross revenue would be more advantageous to that broad middle group.

We have found the framework of a standard reference point for distributional analysis to be a useful one. In an area where value judgments are necessarily the final determinants, there can be no analytically definitive argument for the set we have chosen. The use of some such standard is, however, illuminating; the most useful form of criticism, in our view, should take the form of specifying plausible alternatives. Our application of the inequality measures proposed by Atkinson has confirmed their usefulness. We find them more sensitive than the Gini coefficient, and they have the added advantage of being logically related to a plausible family of utility specifications.

Finally, we must say that our exploration into the arithmetic of income distribution has produced a large volume of numbers; the heavy burden of tables in this paper is only the tip of the iceberg. A substantial amount of interpretation and assessment remains to be done, but we hope that the findings presented here will move the debate on issues of tax and welfare reform forward.

DATA APPENDIX

The data source for all calculations in this paper is the 1966 Brookings Institution Family MERGE File, adjusted to 1970 population and income levels.

The Brookings MERGE File

This file was created by Ben Okner under a grant from the Office of Economic Opportunity from two sets of data, the 1967 Survey of Economic Opportunity and the 1966 Federal Individual Income Tax File. It contains observations on a family basis, combining survey information from the SEO with tax return data from the Tax File. MERGE is in two sections: the first part, the FAM subfile, contains the survey and tax return data for 26,192 Interview Units (families and single individuals) whose Current Population Survey (CPS) income was less than $30,000 in 1966; while the second part, the FAT subfile, has Internal Revenue Service tax-return data only for 46,946 tax-return-filing units with income of at least $30,000. The units in the FAT file represent less than 2 percent of the total number of families, although they represent a much larger percentage of total income; therefore, it is adequate for our purposes to treat the units of the FAT file as if they were Interview Units (IU) and to use estimates for the

missing demographic data we need. In particular, this requires us to estimate the number of persons and children in the Interview Units from the number of exemptions, and to assume that none of these returns are filed by persons who are not the head or wife of an IU. When secondary members of an IU file returns separately from the head's return, their income is not included in the IU's income total, but they are not likely to be counted as dependents. We have used the FAM file plus a 20 percent subsample of the FAT file in our calculations.

The details of the creation of the SEO, Tax, and MERGE files are reported in Okner [10], [11], [12]; SEO Codebook; and Brookings Institution Computer Center [2]. Only a few remarks need to be made here. The MERGE File is intended to represent the noninstitutional CPS population in calendar year 1966, but it is far removed from the original tax and SEO data. Since the two data sources used do not contain data on the same individuals, a complex matching procedure was used by Okner and his associates to associate one or more tax returns with each Interview Unit. The resulting "sample" can be no better than this procedure. Some of the difficulties with the matching procedure have been analyzed by Sims [17], Budd [3], and Peck [13]. It is likely that some of the relationships and distributions in MERGE are distorted measures of reality. We have tried to avoid relying on particularly suspect joint distributions and, therefore, we do not report any results on the impact of the various plans by race, for example.

In addition to the changes introduced by the merging process itself, there are three other ways in which the data were modified: (1) Extensive adjustments for nonreporting and underreporting were made. These are discussed in the Okner papers cited above. (2) Imputations were made for a number of items for which there were no data in the file, particularly the amounts of property, sales, and state and local income taxes paid by individuals, either directly or indirectly via shifting to consumers or owners of capital. (3) The 1966 MERGE File was projected forward to 1970, using routines written at Brookings and control totals from the 1970 Census.

Imputations and Adjustments Made to the MERGE File

Three types of state and local taxes were imputed to all IUs in the file, using routines devised by Okner. The taxes imputed were property tax, state and local income taxes, and sales taxes.

The procedure used for estimating property taxes was as follows. Property income was defined as the sum of interest received, rental income, royalties, estate and gift income, dividends, and 29 percent of income from farming and 14 percent of income from nonfarm business (estimated returns on capital) received by the IU. Negative amounts were not included. A tax rate was applied to this total. The remainder of the direct tax was found by taking percentages of the values of automobiles and owner-occupied housing. It was assumed, in addition, that property taxes levied on the nonland assets of businesses and farms are borne by consumers, and an adjustment was made based on the unit's total consumption. Finally, renters were assumed to bear all of the property tax on their housing, and this amount was estimated from their monthly rent. The procedure for calculating those taxes was modified for IUs who filed itemized tax returns in such a way as to accept the taxes claimed as deductions as the actual taxes paid (apart from the shifting estimates). It should be emphasized that the total property tax figure estimated includes both direct property taxes and indirect taxes assumed shifted to renters and consumers.

The amount of state and local income taxes paid had to be estimated for some IUs. If a tax return associated with an IU had itemized deductions, the amount deducted for state and local income taxes was accepted. Otherwise, the tax rate was estimated from adjusted gross income (AGI) and family size and applied to a "taxable income" defined as AGI minus exemptions of $1,000 each for the taxpayer and wife (if a joint return) and $500 for each dependent. The estimated taxes were added for each tax return in the IU to give the total state and local income tax. The amount of sales tax paid was estimated as a percentage of total consumption expeditures.

The last major adjustment to the data was to project the file forward to 1970. This was done in two steps. First, the sample weights associated with IUs were adjusted to bring the 1966 population to 1970 Census Bureau population figures. The adjustment factor was a function of four variables: (1) age (seventeen classes), (2) race (white/nonwhite), (3) type of area (urban, rural, nonfarm, farm), and the size of the family. Then, the means of the distributions of the amounts of fifteen sources of income and thirty-nine items in the tax returns were adjusted to 1970 levels. No attempt was made to take explicit account of

changes in benefit schedules for such items as Social Security payments.

These procedures stop short of producing an estimate of the total tax burden borne by a family. Specific taxes, such as a gasoline tax, and fees charged for government services, such as motor-vehicle registration charges, are omitted. These taxes do not have income redistribution as an objective and they are small compared to the remainder of revenue collected under the present tax system; therefore, it is acceptable to ignore them.

A much more important omission is the federal corporate income tax. In a truly comprehensive assessment of the redistributive aspects of the taxation system, this tax would have to be considered. In comparing our linear tax-demogrant systems with the status quo, we have left the federal corporate tax unchanged and have made no assessment of who pays it. The adoption of a radically different tax system would surely affect corporate financial behavior, but we ignore this as well as all other responses of the economy.

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