384-76

INSTITUTE FOR RESEARCH ON POVERTY DISCUSSION PAPERS

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ABSTRACT

Support for the two-tier approach to income maintenance for the aged is becoming increasingly widespread. Two-tier formulas combine an income-conditioned bottom tier with an earnings-related top tier in order to achieve both antipoverty and earnings replacement objectives. This paper first refutes the frequent claim that the two-tier approach is more target-efficient in reaching the poor than is the earnings-related top tier with progressive replacement rates. After showing that both approaches can be equally target-efficient, we compare the effectiveness of the two systems in terms of other goals. We also examine how the tradeoffs among goals in moving from one system to the other depend on the correlation between preretirement earnings and current income of the aged. It is seen that the higher is the correlation, the less attractive is the two-tier approach. The paper concludes by demonstrating that a formula with a low tax on current income and a progressive earnings-related benefit schedule can virtually dominate a wide range of two-tier formulas.

1. Introduction

A consensus is developing in the United States over the best way to pay income transfer benefits to the elderly. There is growing support for a two-tier system as the best means to achieve the objectives of income support and earnings replacement. The bottom tier, which is some variant of the negative income tax (NIT), would deal with the problem of poverty among the aged by guaranteeing a minimum income. The top tier, the contributory social insurance retirement program, could then concentrate exclusively on the earnings replacement objective.

Analysts in the U.S. [Korns, 1974; Pechman et al., 1968; Storey, 1975] often contrast the two-tier approach with policies that have relied more heavily on a single earnings related top tier. Old Age Insurance (OAI), the U.S. top tier, has served both earnings replacement and income support objectives. While OAI benefits rise with the level of past earnings, they provide a much higher replacement rate for those with low past earnings than for those with high past earnings. Special minimum benefits, which are paid to those with the lowest covered earnings and sufficient quarters of earnings for eligibility, can result in replacement rates many times the average rate. The major criticism of this use of the top tier to give special help to low income elderly is that it is wasteful and inefficient. Some benefits intended for low income aged go to those with low covered earnings but moderate or high current income. In contrast, under the two-tier approach it is argued that the government can channel money directly to low income elderly by making benefits strictly income-conditioned.[1] As a bonus, revenues saved from this more efficient method of helping the poor may be used for increasing the amount of aid paid to

the elderly poor. (Another advantage claimed for the two-tier approach is that it uses the payroll tax less and the income tax more than do systems allocating a larger share of benefits through the top tier.)

The first task of this paper is to cast doubt on this consensus view.[2] In addition to demonstrating that two-tier systems are not necessarily more efficient in helping the poor, we broaden the analysis by examining the performance of alternative systems in terms of all the major goals and by estimating several tradeoffs among goals. The quantitative results obtained from a simulation procedure permit a systematic assessment of alternatives. Judged from this framework, some variant of the top-tier approach emerges as dominating the two-tier approach.

A problem in all empirical evaluations of transfer alternatives is that the results are likely to be sensitive to the parameters of the underlying distribution. Hence, generalization from a single data set or from data relating to a particular period or country may be misleading. A particularly important parameter in the case of pension schemes is the correlation between earnings before retirement and pretransfer income after retirement. We therefore examine the sensitivity of our results to this correlation.

2. Some Definitions, Assumptions, and a Mathematical Illustration

This section begins by defining the alternative systems. We shall consider three sets of formulas: proportional single tier, progressive single tier, and two-tier. The general formula for the single tier systems is:

$$B_j = \max\begin{cases} \max[G, A_j W_j] - T_j Y_j^c \\ 0 \end{cases} \qquad (1)$$

where B_j is benefits to individual j, G is the system's income guarantee, A_j is the replacement parameter for individual j, T_j is the average benefit reduction rate facing individual j, W_j is individual j's average preretirement covered earnings, and Y_j^c is the current pretransfer income of individual j.

By proportional single tier (PROP), we shall mean a formula whose benefits are simply a constant proportion of preretirement earnings. That is, the parameters in formula (1) are: $G = 0$, $T = 0$ for all j; and $A = k$, $0 < k < 1$ for all j. The single tier may be thought of as progressive if $G > 0$, if A varies inversely with W, and/or if T is positive and is either constant or rises with Y^c. In most of what follows, we let $T = 0$. Then, a progressive single tier (PROG) is a formula in which replacement rates (B/W) decline with past earnings (W), but benefits (B) still rise with W. Thus, PROG lies between a proportional single tier and a flat payment system. Letting $G = 0$ and defining $A_j = a_1 W_j^{a_2}$, one may specify a PROG formula by varying a_2 between 0 and -1 with $a_1 > 0$. As a_2 declines from near zero toward -1 while a_1 changes to hold costs constant, the PROG formula becomes increasingly progressive in the sense that B/W declines faster with W.

In a two-tier (TT) system, we have for top-tier benefits

$$BT_j = \max \begin{cases} \max(GT, A_j W_j) - T_j Y_j^c \\ 0 \end{cases} \tag{2}$$

and for bottom-tier benefits

$$BB_j = \max \begin{cases} GB - t_1 Y_j^c - t_2 BT_j , \\ 0 \end{cases} \tag{3}$$

where GT and GB are the guarantee under the top and bottom tiers and t_1 and t_2 are tax rates between 0 and 1. Adding (2) and (3) and assuming $GT = 0$,

we have total benefits under the two-tier system,

$$B = \max \begin{cases} GB + (1 - t_2)\ (A_j W_j) - (t_1 + T_j)Y_j^c + t_2 T_j Y_j^c \ . \\ 0 \\ A_j W_j - T_j Y_j^c \end{cases} \qquad (4)$$

These formulas and the analysis below abstract from the following features of actual benefit formulas: dependents' allowances, alternative definitions of past earnings, methods for integrating benefits of two-earner couples, and differences in rates by source of pretransfer income of the elderly. We assume that all elderly units are of the same size and contain at most one former worker. Although we do not consider the effect of varying the definition of past earnings, most of the analysis is consistent with several definitions.

A good starting point for thinking about the distributional effects of pension systems is to examine how the proportional single tier influences income inequality. A simple mathematical illustration can bring out some points not generally emphasized in the literature. Let the proportional single tier be

$$B_j = KW_j \ . \qquad (5)$$

The expression for total income, Y_j, is

$$Y_j = KW_j + Y_j^c \ . \qquad (6)$$

We are interested in the inequality of pretransfer income, Y^c, relative to the inequality of posttransfer income, Y. To measure changes in inequality, we use the coefficient of variation (C_{yc} and C_y).

The difference between C_{yc} and C_y may be expressed as

$$C_{yc} - C_Y = \text{Dif} = C_{yc} - \Big\{\big[\alpha C_w + (1 - \alpha)C_{Yc}\big]^2 \qquad (7)$$

$$- 2\alpha(1 - \alpha)C_w\ C_{Yc}(1 - \rho)\Big\}^{1/2},$$

where ρ is the correlation between W and Y^c and where $\alpha = \frac{K\bar{W}}{K\bar{W} + \bar{Y}^c}$,

or the share of benefits in total income. We now consider the conditions for Dif $\lesseqgtr$ 0. Rewriting (7) and squaring both sides, we have

$$C_Y^2 c \gtreqless \left[\alpha C_w + (1 - \alpha) C_Y c\right]^2 - 2\alpha(1 - \alpha) C_w C_Y c(1 - \rho) \tag{8}$$

and $$0 \gtreqless \alpha^2(C_w^2 + C_y^2 c) - 2\alpha C_Y^2 c + 2\alpha(1 - \alpha)\rho C_w C_Y c \quad . \tag{9}$$

It follows that Dif $\gtreqless$ 0 according to whether

$$\frac{2 C_Y^2 c - \alpha (C_w^2 + C_Y^2 c)}{2(1 - \alpha) C_Y c C_w} \gtreqless \rho \quad .$$

The left-hand side is greater than 1 as long as $\alpha < \frac{2C_Y c}{C_Y c - C_w}$.

This condition holds if, as is generally true, $C_Y c > C_w$. Since ρ must be less than 1, we conclude that Dif > 0. Differentiating Dif, the size of the reduction in inequality, with respect to ρ and C_w, we have

$$\frac{\partial(\text{Dif})}{\partial \rho} < 0, \text{ and} \tag{11}$$

$$\frac{\partial(\text{Dif})}{\partial C_w} < 0. \tag{12}$$

Thus, the proportional single tier generally reduces income inequality among the aged. The size of the reduction is higher, the less the inequality of W relative to the inequality of Y^c and the lower the correlation between W and Y^c. The explanation is straightforward. Since benefits are a constant proportion of W, inequality in benefits (B) will equal inequality in W, which is generally less than inequality in Y^c. Adding B to Y^c should make the total, Y, less unequal than the original component, Y^c, even if there is a perfect positive correlation between W and Y^c. The

reason is that, although elderly persons with high pretransfer incomes have high past earnings and, therefore, receive high absolute benefits, their relative gain is less than the relative gain to the low income aged. It is natural that the decline in inequality is larger, the lower is the correlation between W and Y^c. A lower correlation means more low income aged receiving high absolute benefits and more high income aged receiving low absolute benefits.

3. The Simulation Approach and the Data

Pursuing the mathematical approach to evaluate alternative systems yields results that are ambiguous or difficult to interpret. We therefore turn to simulation. To perform the simulations requires data on the past earnings and current income of a representative sample of elderly units. Data sets of this type are generally not available. To overcome this obstacle, we use the bivariate normal distribution to generate a hypothetical joint distribution of W and Y^c. The average and variance of W and Y^c come from the 1969 Family Expenditure Survey data [Israel. Central Bureau of Statistics, 1970] on the earnings of 35-64 year-old male workers and the pretransfer income of the elderly in Israel in 1969. The unit of analysis is the average household (1.4 persons) headed by an aged person. Using the actual averages and variances along with two assumed values (0 and .8) for the correlation between W and Y^c (ρ), we derive two distributions. These distributions underestimate the true number of elderly units with very low incomes. We correct for this bias by giving each income interval its actual share of the total income of the elderly population while maintaining the initial averages, variances, and correlations.

Although information on W and Y^c comes from Israeli survey data, there are several similarities between Israeli and recent U.S. figures. It is coincidental that the mean size of aged units and the ratio of the average pretransfer income of the aged to the average earnings of male prime-age workers are approximately the same in both countries. The degree of inequality in pretransfer income of the elderly also appears similar, but the inequality in current earnings of prime-age workers is probably somewhat higher in the U.S. than in Israel.

In comparing alternative benefit formulas we hold costs constant. As a benchmark we take the average benefit in 1974 as a percentage of the average wage in 1974 and apply this percentage to the 1969 figures. Since this ratio was similar in Israel and the U.S. in 1974, and all distributions and benefits are in relative wage terms, our results may be broadly interpreted as applying to either country.[3] The parameters of the initial distributions appear as the first row in Table 1. To perform the simulations, we first specify the form of the benefit formula and some of its parameters. We then determine the unspecified parameters in a way that satisfies the cost constraint. In estimating costs and distributional effects, we assume that the work behavior of the elderly is unaffected by the type of benefit formulas used, and that recipients receive the exact benefits for which they qualify.

4. The Results

The target-efficiency comparison

The analysis begins with the issue of which method of introducing progressivity is most efficient in reaching the low income elderly. Not

Table 1

Distributional Effects of Alternative Benefit Formulas

	Gini	Atkinson ε=1.2	Atkinson ε=2.0	CV	Percent in Poverty	Average Income of Bottom Decile as % of Average Wage	Benefit Share to Pretransfer Poor (%)
Pretransfer Income:	.60	.69	.86	1.27	50	2	-
Posttransfer Income, ρ=0.8:							
(1) PROP	.49	.45	.62	1.00	30	10	26
(2a) TT, Low GB, t	.43	.30	.42	.91	4	25	38
(3a) TT, High GB, t	.42	.30	.40	.90	0	29	39
(4) PROG, Low $\|a_2\|$	.42	.30	.43	.86	15	21	38
(5) PROG, High $\|a_2\|$	.38	.25	.35	.80	0	29	46
(6a) PROG, High G, Low $\|a_2\|$	.42	.30	.42	.88	0	25	38
Posttransfer Income, ρ = 0:							
(1)PROP	.40	.30	.44	.81	13	17	50
(2b) TT, Low GB, t	.37	.23	.32	.77	1	29	55
(3b) TT, High GB, t	.36	.22	.30	.76	0	35	55
(4) PROG, Low $\|a_2\|$	.37	.23	.33	.77	3	26	50
(5) PROG, High $\|a_2\|$	.36	.22	.31	.77	0	32	50
(6a) PROG, High G, Low $\|a_2\|$	.37	.24	.34	.78	0	26	50

Note: The exact formulas are as follows:

Formula	ρ	
(1)	.8, 0	$B_j = .32W_j$
(2a)	.8	$B_j = \max \begin{cases} 163 + (1-.4)(.27W_j) - .4Y^c \\ .27W_j \end{cases}$
(2b)	0	same as 2a except substitute .29 for .27
(3a)	.8	same as 2a except substitute 226 for 163 and .8 for .4
(3b)	0	same as 2b except substitute 262 for 163 and .8 for .4
(4)	.8, 0	$B_j = (15W_j^{-.56})\ W_j$
(5)	.8, 0	$B_j = (100W_j^{-.85})\ W_j$
(6a)	.8	$B_j = \max[191, (4.1W_j^{-.38})W_j]$
(6b)	0	$B_j = \max[191, (3.4W_j^{-.35})W_j]$

all options are considered. In particular, a pure negative income tax is not examined because of the desire to preserve the social insurance feature for a large share of the transfers [Feldstein, 1975]. Our approach is to start with the proportional single tier (PROP) and to consider the most efficient way to add progressivity to the system.

The distributional effects of PROP are interesting in themselves. The mathematical illustration in section 2 shows that PROP will reduce inequality if the inequality of W is less than the inequality of Y^c. In our populations, where the coefficients of variation (CV) are .70 for W and 1.27 for Y^c, PROP reduces income inequality and poverty substantially (see Table 1). The results also bear out the conclusion that inequality reductions are larger, the lower is the correlation between W and Y^c. In spite of PROP's substantial redistributive effects, poverty and inequality remain at generally unacceptable levels.

In an effort to do more for the elderly poor, analysts often consider the progressive single-tier (PROG) and the two-tier (TT) systems. One simple point that is sometimes ignored in comparisons of these systems is that their distributional effects vary widely, depending on the specific parameters employed. Table 1 displays examples of PROG and TT systems that illustrate such variation. The two TT systems employ the same proportional top tier (BT = .27W); but one bottom tier has a higher guarantee and tax rate than the other. In PrT formulas 4 and 5, G = 0 and the replacement parameter (A in Formula 1) varies inversely with W , at lesser (a_2=-.560) or greater (a_2=-.85) rates. The other PROG system (Formula 6) sets a flat minimum payment (G = 191) but uses a very moderate rate of decline in A (a_2 = -.38). All the formulas have the same budget costs.

It is immediately apparent that the TT system is not necessarily more efficient at helping the poor than is the PROG. Note that when ρ equals .8, the PROG systems channel as much or more benefits to the pretransfer poor than do the TT systems. The PROG systems also do as well or better than the TT systems in reducing inequality. Even in the case of the measure most favorable to the TT system, the average income of the bottom decile, one of the PROG alternatives does at least as well as TT formulas.

Most analysts expect TT systems to reach the poor more efficiently because the PROG "wastes" expenditures by providing special benefits to all elderly with low past earnings, including those with moderate or high current income. It seems inefficient to target special expenditures intended for elderly with low Y^c on elderly with low W. Waste must occur as long as W and Y^c are less than perfectly correlated. But it is easily and often overlooked that some bottom-tier benefits must also miss their target if the bottom tier's tax rate on current income and on top-tier benefits is less than 1. Our results indicate that one type of waste is not always more serious than the other.

When $\rho = 0$, the proportional benefit formula has more significant effects on poverty and inequality than when $\rho = .8$. But the additional reductions in poverty and inequality achieved by moving to either the TT or PROG formula are smaller. The decline in marginal effects is slightly larger for the PROG formulas than for the TT formulas. Nevertheless, it remains true that given a representative TT formula, one can find a PROG formula progressive enough to attain equal target-efficiency. Thus, in order to identify the advantages of one approach over the other, we must compare the alternatives on the basis of additional goals.

A broader comparison of the PROG and TT

This section draws on the simulation results to examine the performance of equal cost PROG and TT systems in achieving several goals. Here, the goal of reducing poverty and inequality takes its place alongside the goals of avoiding stigma, preserving work and savings incentives, and ensuring an adequate retirement income.[4]

The comparison is made in two ways. We first compare formulas that are representative in that they resemble systems commonly employed or suggested. We then contrast formulas that produce equal gains for the poor, at the same level of expenditures.

The overall benefit pattern for two representative systems (PROG Formula 6 and TT Formula 3) appears in Table 2. The benefit patterns illustrate what lies behind the distribution effects reported in Table 1. Both systems provide a sufficiently high minimum benefit to eliminate poverty. But the TT raises the bottom decile's income more than does PROG (29 to 25 when $\rho = .8$). Still, the TT and PROG induce similar effects on overall income inequality. The reason is that TT benefits are lower for middle income groups and higher for high income groups. Note that at any level of Y^c, the TT system pays more than the PROG to groups whose W lies above 1300.

On the issue of work and savings incentives of the elderly, the PROG has the obvious advantage. The bottom-tier tax rate under the TT system lowers the returns to current earnings and to savings for all elderly below the breakeven income by imposing an 80 percent tax on current income. Since those above the bottom tier's breakeven income face no tax rate, the

Table 2

Benefit Levels and Replacement Rates by Preretirement Wages
for Representative PROG and TT Systems

	PROG Formula 6[b]			TT Formula 3[b]						PROG Formula 5[b]		
				$Y^c = 0$			$Y^c = 100$					
W[a]	B	ΔB/ΔW	B/W	B	ΔB/ΔW	B/W	B	ΔB/ΔW	B/W	B	ΔB/ΔW	B/W
400	191		.48	248		.62	168		.42	246		.61
		.13			.05			.05			.08	
600	216		.36	258		.43	178		.30	261		.44
		.22			.05			.19			.06	
800	259		.32	269		.34	216		.27	273		.34
		.19			.05			.27			.05	
1000	297		.30	280		.28	270		.27	282		.28
		.18			.22			.27			.04	
1200	332		.28	325		.27	325		.27	290		.24
		.17			.27			.27			.03	
1400	366		.26	378		.27	378		.27	296		.21
		.16			.27			.27			.03	
1600	397		.25	432		.27	432		.27	302		.19

[a] Mean W is 820.

[b] See Table 1 for parameters ($\rho = 0.8$).

average marginal tax rate over all elderly is lower (32 percent) than the bottom-tier rate of 80 percent. Still, some TT recipients find their work incentives sharply reduced. In contrast, the PROG does not lower the elderly's return from work and savings at all.

Another type of incentive issue, the work incentives of those under retirement age, depends on the marginal return to each unit of average covered earnings.[5] Here, the comparison does not yield a clear result. The TT's top tier pays an additional .27 percent for each 1-unit increase in average covered earnings. However, for those receiving bottom-tier benefits, the net gain reported in Table 2 declines to .05 because of the bottom tier's 80 percent tax rate. Under the PROG system, increased covered earnings up to 60 percent of the average wage yield no increase in benefits because of the minimum benefit provision. But above this level of W the marginal gain begins at .2 and then declines moderately, reaching .16 at twice the average wage.

The goal of avoiding stigma has at least two elements, which Weisbrod [1970] has designated as external and internal stigma. External stigma develops when the recipient has to admit that he is poor in order to receive benefits. This generally takes the form of submitting to a means test in a special program intended for the poor. Merely by receiving benefits in a program in which few or no nonpoor participate, the recipient begins to feel stigma. The fact that many eligibles do not apply for special benefits earmarked for low income elderly attests to the reality of the stigma effects.[6]

The TT system clearly suffers from this internal stigma. In fact, to the extent that stigma induced by the TT's bottom tier results in lower

take-up rates than the PROG, the TT can lose its slight advantage in reaching the lowest income elderly. An internal stigma problem arises when the recipient is paid benefits he did not earn and feels he does not deserve, even if no one else knows about the unearned benefits. Although features of the PROG such as the minimum benefit may induce internal stigma, the problem is likely to be more severe under the TT system because of its strict separation of benefits into earnings-related (or earned) and income-related (or unearned) categories.

The adequacy goal relates to how well elderly people can maintain their preretirement living standard. Typical measures of adequacy are the ratio of benefits to preretirement earnings and the ratio of total income (earned income, private pensions, and benefits) to preretirement earnings. Usually one program is said to be more adequate if it provides higher overall benefits. The ratio of total aggregate benefits to total aggregate earnings will not vary with the way in which benefits are distributed. But where total benefits and wages are the same, as in our analysis, in what sense can the adequacy of alternative formulas differ? One possibility is the differences between formulas in the average of individual replacement rates. Using this criterion, it is clear that adequacy rises directly with the progressivity of the benefit formula with respect to preretirement earnings. The reason is that a 1-unit change in the benefits of aged with low W has a larger percentage effect on their replacement rates than does a 1-unit change in benefits of aged with high W. Yet the most progressive formula is not necessarily the most adequate one, since aged with moderate and high W would find their retirement income far too low to approximate their preretirement living standards.

We therefore need to take a more detailed view of the pattern of replacement rates in assessing adequacy. It is sometimes charged that PROG systems sacrifice moderate replacement rates at the middle and top in order to raise benefits for the poor. But for equal costs, a two-tier system must also reduce replacement rates at the top and middle on behalf of the bottom. Indeed, for the comparison of Formulas (3) and (6), the PROG's replacement rates for elderly with no current income are almost as high as the TT's for high wage retirees and are even higher for those in the middle ranges of W. The different absolute benefits translate into only a slight difference in replacement rates. Of course, most elderly have some pretransfer income. To assess how adequate, on average, are total incomes of the elderly, we measured the mean total replacement rate at each level of preretirement wages. These appear in Table 3. Again, note that the representative PROG's total replacement rates are almost as high or higher than the TT's for the middle and upper ranges of W.

We may now summarize the comparison of the representative PROG and TT formulas. The TT does <u>not</u> enjoy a clear superiority over the PROG. Instead, the choice between the two requires trading off some of one objective for more of another. TT Formula 3 raises the income of the bottom decile to higher levels, but the PROG Formula 6 does as well in reducing overall income inequality. The PROG has clear advantages in achieving the goals of maximizing work incentives and minimizing stigma. There is basically a standoff on the adequacy goal.

The tradeoffs differ with the level of ρ. At the lower ρ, the TT's advantage in helping the lowest income elderly is greater, while its disadvantages are the same. That is, the "price" of a further increase in

Table 3

Average Total Replacement Rates by Preretirement Wages

	ρ = 0.8				ρ = 0		
	PROG Formulas		TT		PROG Formulas		TT
Wage Group	5	6	Formula 3	PROG*[a]	5	6	Formula 3
0- 246	1.26	1.11	1.26	1.27	3.42	3.28	2.99
247- 533	.83	.69	.72	.75	1.66	1.52	1.47
534- 820	.77	.71	.70	.72	1.01	.96	.94
821-1107	.78	.79	.75	.78	.73	.74	.73
1108-1394	.81	.85	.85	.83	.56	.61	.62
1395-1671	.82	.88	.89	.85	.46	.53	.55
1672+	.79	.86	.91	.83	.34	.42	.48

[a]The formula for PROG* is:

$$B = \max \begin{cases} \max[225, (2.0W^{-.23})W] - .2Y^{c} \\ 0 \end{cases}$$

This formula is discussed later in the text.

incomes of the bottom decile is lower. Still, the lower price should not necessarily influence policy makers' attitudes toward the TT because at the low ρ the gains of the lowest income elderly are larger under either system. Thus, in this case, the income level of the bottom decile may be adequate enough under the PROG for the policymaker to prefer focusing on other goals.

It is possible to equalize the PROG and TT effects on low income families by introducing sufficient progressivity into the PROG formula. One could utilize a PROG whose benefits rise only slightly with W. For example, achieving the same income gains for the bottom decile as TT Formula 3 requires that the PROG earnings-replacement schedule be extremely progressive, as in Formula 5. But while helpful to antipoverty goals, such extreme degrees of progressivity deprive the PROG of some of its advantages. Although PROG Formula 5 still offers better work incentives to the elderly than TT Formula 3, it widens the PROG's disadvantage in providing adequate benefits to elderly with moderate and high W. As reported in Table 2, the benefit replacement rates to elderly with high W are about 19 percent, or well under the 27 percent reached through the TT system. Note further that mean total replacement rates for high W groups reported in Table 3 are lowest under PROG Formula 5. Shifting to a highly progressive top tier decreases the return to added preretirement earnings and therefore rewards increases in preretirement earnings far less. The extremely progressive PROG also has less of an advantage over the TT in minimizing stigma. In fact, flattening benefits as in Formula 5 could call into question the social insurance nature of the program and lead to reduced public support. At a low ρ, the PROG system would have to become

even more progressive than Formula 5 in order to attain the same income gains at the bottom as TT Formula 3. It might require fully eliminating the earnings-related feature of the program.

Toward dominance over the two-tier system

The tradeoff analysis suggests it may be possible to construct formulas that dominate representative TT formulas. The PROG enjoys a substantial advantage in terms of the work incentive goal. If an amended PROG system gave up part of this advantage in order to accomplish more of other goals, could it claim clear superiority over the TT system?

The ways to amend the PROG system are straightforward. To do as much for the elderly in the bottom income decile as the high guarantee TT, raise the PROG's guarantee. Paying for this increase by giving up some of its incentive advantage means making PROG benefits subject to a tax on current income. To match the TT's advantage in providing moderate and high income elderly with a reasonable marginal return on preretirement covered earnings, we use a moderate reduction in A with increases in W. Finally, of course, the total budget costs of the system are held constant.

The figures in Tables 3, 4, and 5 permit a direct comparison between the new system, PROG*, and the two TT systems. In terms of the distributional goals, the PROG* generally outperforms both TT systems. When $\rho = .8$, the PROG* channels as much or more income to the bottom decile, provides a higher benefit share to the pretransfer poor, and achieves lower overall inequality. When $\rho = 0$, PROG* benefits to the bottom decile are slightly lower than benefits from the high guarantee TT, but even in this case, the share of benefits to the pretransfer poor is higher under the PROG* than under the TT. Despite the 20 percent tax rate applied to

all families, the PROG* system still has an advantage in disincentives in that the average marginal rate is lower and no group faces an exorbitant tax rate.

The PROG* surpasses the TT systems in providing replacement rates for elderly with moderate and high preretirement wages. Note, for example, that at earnings of 1,200 (50 percent above the average) the benefit replacement rate is 7-10 percentage points above that provided by the TT systems. The reduction in the progressivity of the replacement parameter tends to preserve the level of total benefits of high wage groups despite the tax on current income. In addition, within each wage group there is a redistribution of benefits from those with high current income. This also serves to raise average total replacement rates. The TT system ignores income differences for those above the bottom-tier breakeven.

The marginal return from average preretirement covered earnings also improves under the PROG* system over most of the past earnings distribution. The pretax PROG* benefit schedule employs very moderate progressivity above the PROG* minimum benefits. As a result, the marginal returns are higher under the PROG* than under the TT systems, for those with past earnings from about half the average to twice the average wage.

With regard to stigma, the PROG* retains the advantage over TT systems of avoiding a special program for low income elderly, although it does lose the pure PROG's advantage in avoiding all income tests. However, unlike the PROG, the PROG* is able to retain the earnings-related nature of the system while still providing very high assistance to the poor.

Table 4

Comparison of PROG* and TT Alternatives
($\rho = 0.8$)

Distributional Effects	PROG* System			Low Guarantee TT System, Formula 2			High Guarantee TT System, Formula 3		
Income of bottom decile as % of average wage	29			25			29		
Gini	.39			.43			.42		
Coefficient of variation	.80			.91			.90		
Atkinson: $\varepsilon = 1.2$	.26			.30			.30		
$\varepsilon = 2.0$	.37			.42			.40		
Benefit share to pre-transfer poor (%)	43			38			39		
Average marginal tax rate (%)	13			20			32		
Benefits (replacement rates) by W, $Y^c = 0$:	B	$\Delta B/\Delta W$	B/W	B	$\Delta B/\Delta W$	B/W	B	$\Delta B/\Delta W$	B/W
400	225		.56	228		.57	248		.62
		.20			.16			.05	
600	264		.44	260		.43	258		.43
		.33			.17			.06	
800	329		.41	293		.37	269		.34
		.30			.16			.06	
1000	389		.39	325		.33	280		.28
		.29			.16			.22	
1200	447		.37	357		.30	325		.27
		.28			.17			.27	
1400	503		.36	390		.28	378		.27
		.27			.21			.27	
1600	557		.35	432		.27	432		.27

Table 5

Comparison of PROG* and TT Alternatives
($\rho = 0$)

Distributional Effects	PROG* System			Low Guarantee TT System, Formula 2			High Guarantee TT System, Formula 3		
Income of bottom decile as % of average wage	30			29			35		
Gini	.33			.37			.36		
Coefficient of variation	.68			.77			.76		
Atkinson: $\varepsilon = 1.2$	.19			.23			.22		
$\varepsilon = 2.0$	.28			.32			.30		
Benefit share to pre-transfer poor (%)	61			55			56		
Average marginal tax rate (%)	13			18			27		
Benefits (replacement rates) by W, $Y^c = 0$:	B	$\Delta B/\Delta W$	B/W	B	$\Delta B/\Delta W$	B/W	B	$\Delta B/\Delta W$	B/W
400	225		.56	233		.58	285		.71
		.20			.17			.06	
600	264		.44	267		.45	297		.50
		.33			.18			.06	
800	330		.41	302		.38	308		.39
		.31			.18			.06	
1000	392		.39	337		.34	320		.32
		.30			.18			.14	
1200	451		.38	372		.31	348		.29
		.29			.18			.29	
1400	509		.36	407		.29	406		.29
		.28			.29			.29	
1600	564		.35	464		.29	464		.29

5. Conclusions

Several conclusions follow from the findings in this paper. a) The two-tier approach is not necessarily more target-efficient in reaching the poor than is the progressive single tier (PROG) approach; for a wide range of TT formulas, one can find a PROG formula that provides an equal share of benefits to the poor. b) Looked at on the basis of their performance in achieving several goals, representative TT and PROG Formulas each have advantages and disadvantages. Choosing one formula over another requires estimating the tradeoffs among goals and deciding the weights to apply to each goal. Considering representative TT and PROG formulas, one finds that TT formulas do more to raise incomes of the poorest 10 percent of the aged while the PROG formulas do more to preserve work incentives, to limit stigma, and to reduce overall income inequality among the aged. c) The relative effectiveness of TT versus PROG formulas varies with the correlation between preretirement earnings and postretirement income. The higher is the correlation, the lower is the relative effectiveness of TT formulas. d) Amending the PROG formula by adding a low tax rate on current income and raising the minimum benefit yields a new formula, PROG*, that virtually dominates representative two-tier formulas.

Notes

[1]The fact that federal and some state and local government employees are not covered by OAI makes the problem particularly acute in the U.S. These employees can qualify for a generous government pension and still gain eligibility for highly subsidized minimum OAI benefits.

[2]By consensus view, we are referring to the belief that an ideal two-tier approach is better than an ideal single-tier approach. Our results do not imply that the existing OAI program, with its incomplete coverage and dependents' allowances, is more effective than a sensible two-tier system.

[3]The Israeli data discussed here and in the previous paragraph come from Habib [1976] and Israel National Insurance Institute [1975]; the U.S. data come from the Social Security Administration [1975] and the U.S. Bureau of the Census [1975].

[4]Equity is the most complex goal to describe and to analyze. Even for social insurance retirement programs financed through payroll taxes, there are several views as to what is equitable. The issue primarily turns on whether equity demands paying a return on past contributions and, if so, what rate is appropriate. Other concepts come into play when dealing with those benefits financed through general revenues. Here, the equity criteria are similar to those applying to transfer programs for the nonelderly. A general analysis of the equity implications of alternative formulas would require too lengthy a treatment for the purposes of this paper. An examination of these issues appears in Habib and Lerman [1976a; 1976b].

[5]A marginal increase in earnings in a given period raises the worker's average covered earnings by 1 divided by the number of periods considered. Note that we are referring here to the benefit per unit of <u>average</u> covered earnings, not <u>total</u> covered earnings.

[6]Atkinson [1969, pp. 61-77] found that in Britain, the share of elderly eligible who do not claim income-tested benefits remained high, even after the introduction of a new supplemental benefit program that simplified procedures for claiming benefits, clarified and standardized the conditions for entitlement, and increased the program's publicity.

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