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ABSTRACT

This paper presents an empirical analysis of the real internal rate of return to the cld age insurance (OAI) portion of the cld age, survivors, and disability insurance (OASDI) program for worker-only beneficiaries retiring between 1967 and 1970. Section I reviews the analytical background for this study. The issues concern alternative measures of individual equity and the empirical approach to their measurement. The procedures used in five papers on the subject by John Brittain (1972), Colin D. Campbell and Rosemary G. Campbell (1967), Henry Aaron (1974), Yung-Ping Chen and Kwang-wen Chu (1974), and Ubadigbo Okcnkwc (1975) are also described. Sections II and III describe the basic model employed and the results. The authors' use of a random sample of longitudinal microdata on actual earnings histories, the feature which distinguishes their approach from previous studies, is also described. The final section compares the authors' results with those of other studies and sets out plans for extension of the analysis. References are included along with an appendix showing detailed tabular results of average internal rates of men and wcmen (1968-1970). (Authors/WL)

STUDIES IN INCOME DISTRIBUTION

INTERNAL RATES OF RETURN TO RETIRED WORKER-ONLY BENEFICIARIES UNDER SOCIAL SECURITY, 1967-70

by

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ABSTRACT

The average expected real internal rate of return at retirement to social security old-age insurance for a random sample of worker-only beneficiaries retiring between 1967 and 1970 is 14.8 percent. While not directly comparable, this rate is somewhat higher than that found in earlier studies. Much of the difference between this rate and earlier ones is due to the more complete representation of workers with low earnings in a random sample of actual case histories than in a representative individual approach. Workers with low earnings have substantially higher rates of return than workers with high earnings. In addition, there is little difference in the way various groups of people have fared under the system after lifetime earnings, labor force participation, and expected mortality have been accounted for.

NOTE

This is the fifth in a series of reports on the distribution of income, taxes, and transfer payments in the population. Analyses in this series focus on the following:

(1) short-term projections of the March Current Population Survey (CPS)--the principal data base currently available for analyses of distribution of annual income--under alternative assumptions about population growth and marriage rates;

(2) estimation of tax liabilities on the CPS;

(3) changes in the distribution of income as a result of changes in the tax-transfer system;

(4) evaluations of the quality of income and demographic data, as reported in the CPS;

(5) analyses of individual equity under the tax-transfer system.

The early studies in the series present analyses based on population and income as reported in the CPS and do not incorporate corrections for population undercounts, understatement of income, and other errors.

The projection and modeling work underlying the studies is an ongoing project of the Division of Economic and Long-Range Studies, which is headed by Dorothy S. Projector, and the methods used are under continuing review and development. This series will report the methods and results to policymakers and to research analysts.

Dorothy S. Projector, Daniel Radner, and Frederick Scheuren made helpful suggestions and comments at various stages of the study. Research assistance was provided by Suzanne Worth and the manuscript was prepared by Joan Reynolds.

John J. Carroll
Assistant Commissioner for
Research and Statistics

October 1976

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INTRODUCTION

This is the first in a projected series of studies of individual equity under the social security program. This paper presents an empirical analysis of the real internal rate of return to the old age insurance (OAI) portion of the old age, survivors, and disability insurance (OASDI) program for worker-only beneficiaries retiring between 1967 and 1970. Section I reviews the analytical background for this study. The issues concern alternative measures of individual equity and the empirical approach to their measurement. The procedures used in five papers on the subject by John Brittain (1972), Colin D. Campbell and Rosemary G. Campbell (1967), Henry Aaron (1974), Yung-Ping Chen and Kwang-wen Chu (1974), and Ubadigbo Okonkwo (1975) are also described. Sections II and III describe the basic method employed and the results. Our use of a random sample of longitudinal microdata on actual earnings histories, the feature which distinguishes our approach from previous studies, is also described. The final section compares our results with those of other studies and sets out plans for extension of the analysis.

I. Background

A number of authors have been concerned with the empirical analysis of individual equity under the social security program. They examined the treatment of workers with characteristics such as race and age at entry into the labor force. While these studies differ in detail, their basic method of approach is similar, that is, to calculate measures of individual equity for hypothetical case histories which are thought to be representative of the life-cycle experience of different individuals with given characteristics. This method is the representative individual approach. In contrast, we calculate measures of individual equity for a sample of actual case histories. These measures are aggregated over the characteristics of interest.

A. Measures of Individual Equity

Two measures of individual equity--the internal rate of return and the cost-benefit ratio, are widely accepted. As defined here, the internal rate of return is the interest rate which equates the accumulated value of tax payments with the present value of expected benefits computed at the date of retirement. Assuming that all taxes are paid and all benefits are received on the first day of each year, then we may write the following simplified expressions.

$$A = \sum_{i=1}^{i'} T_i(1+R)^{i'-i+1} \qquad (1)$$

and

$$V = \sum_{i=i'+1}^{\infty} S_i B_i (1+R)^{i'-i+1} \qquad (2)$$

where the time subscript, i, is set to one in the year of entry into covered employment--the first year in which taxes were paid--and the time subscript i' is the index of the last year of covered employment. Also

A = accumulated value of tax payments,

T_i= tax payments in year i,

R = internal rate of return,

V = present value of expected benefits,

B_i= benefit payments in year i, and

S_i= probability of surviving from the year of retirement to year i.

Therefore, R is the interest rate for which $A=V$. If we add a time subscript, i, to R, indicating that we are referring to the actual interest rate in year i, then the cost-benefit ratio is given as A/V. Clearly, the relationship between the two measures is that the internal rate of return is the interest rate (constant over time) which would yield a cost-benefit ratio of one.

The choice between the two measures is somewhat arbitrary, resting on the significance of each measure's deficiencies relative to its intended use. The calculation of the cost-benefit ratio involves the arbitrary selection of an interest rate or interest-rate series. For example, Campbell and Campbell used the rate of interest on series-E bonds for 1937 until 1963 and 4 percent thereafter. This represents the judgment that the rate of interest on series-E bonds was the proper measure of the opportunity cost of tax payments. It also embodies the judgment that this opportunity cost was equal for each individual. Such an assumption is difficult to defend if comparisons across income groups are to be made. Brittain and Aaron partially avoid this problem by presenting results for a number of different interest rates. Given an interest rate, however, the cost-benefit ratio has the advantage of yielding quantitative measures of the amount of the net transfer $(V-A)$. This is not the case for the internal rate of return.

We (along with Brittain, Chen and Chu, and Okonkwo) have calculated internal rates of return. Two factors are involved in this decision. First, the internal rate of return is the most useful way of presenting the net result of the program's operation over the individual's lifetime in a purely descriptive sense. Thus, readers concerned with comparing the operation of the system to alternative sets of welfare criteria may do so by relating the computed internal rates of return to their own judgments as to the true opportunity cost of tax payments. Such comparisons are valid in spite of the compulsory nature of the system. Even if one completely rejects the notion of a contributory system, which suggests recognition of a *quid pro quo* component of benefits, and views the operation of the system as a pure transfer, the relative values of the rate of return may be viewed as measures of the net result of a tax-transfer program which is separate from other taxes and transfers in the economy.

The second reason is computational efficiency. It is very costly to calculate a large number of cost-benefit ratios (one set for each assumed interest rate series) for a substantial number of individual case histories Also, it is impossible to display the results in a meaningful way. The internal rate of return is calculated only once for each individual.

B. The Representative Individual Approach

The representative individual approach is the construction of life-cycle earnings and benefit profiles for hypothetical individuals differentiated by a finite number of indentifiable characteristics. These life-cycle patterns may be fairly simple as in Campbell and Campbell or more detailed as in Aaron and Okonkwo.

Campbell and Campbell consider workers who began paying taxes in 1937 and retired in 1967. The earnings levels in each year are fixed at the annual maximum taxable base under the prevailing social security act. Alternative cases considered are workers with three-fourths or one-half of this base. Chen and Chu added the case of a worker with annual earnings equal to the average earnings of all workers. Brittain used average earnings but added a number of other cases where earnings, starting at various levels, grew at different constant rates over time.

Both Aaron and Okonkwo sought to take account of the relationship between age and earnings. Okonkwo combined a time series of cross sections derived from published census data on income for broad age groups in 1939, 1949, 1959, and 1969. Using this method, the 1939 earnings of a worker aged 30 in that year was the average earnings of all workers aged 25-34 in 1939; the earnings for this hypothetical worker in 1949 was the average over all workers aged 35-44 in 1949. Earnings in years between the censuses were interpolated. Worker characteristics distinguished in each cross section (and therefore analyzed in the results) were age, race, education, marital status and region of residence.

In contrast to Okonkwo's use of a time series of cross sections, Aaron relied on a single, more detailed cross section. His approach was to estimate a regression equation (one for each of four sex-race subgroups) for earnings from the 1967 *Survey of Economic Opportunity*. In each of the four equations, the logarithm of earnings was regressed on dummy variables for six education levels and nine age groups (implying 54 dummy variables), standard metropolitan statistical area (SMSA) or non-SMSA, four regions of residence, union status and marital status. This procedure makes possible the construction of a large number of different earnings profiles.

The calculation of the benefit stream is much simpler. Most authors compute the benefit at the date of retirement using either the actual benefit formula or a variant of the present formula extrapolated into the future. The exception is Brittain who specifies a constant relationship between average benefits and average earnings over time. This assumption permits him to estimate the rates of return for future retirees within the constraints of a closed system. That is, the tax rate to be applied to earnings in each year is the rate necessary to finance benefits on a pay-as-you-go basis.

Another set of factors needed to compute the present value of expected benefits is survivor probabilities. Brittain and Chen and Chu use the official Social Security Administration age-sex specific survivor rates. Campbell and Campbell use life expectancies from the *Life Insurance Fact Book*. The Campbell and Campbell approach to the computation of V is not exactly the same as that defined above although the qualitative results are similar. They employ the annuity certain approach which does not directly require survivor probabilities. Instead, the present value of benefits is calculated for only a limited number of years into the future equal to the worker's life expectancy at retirement. Chen and Chu also employ this approach but use the method based on survivor probabilities (life annuity approach) as well. Aaron and Okonkwo sought to introduce differentials in survivor probabilities corresponding to the level of disaggregation used in the construction of their representative earnings profiles. Therefore, they applied the differentials to U.S. life table survivor probabilities by sex, race, income, education, and marital status as reported by Evelyn M. Kitagawa and Philip M. Hauser (1973).

C. The Individual Case History Approach

An alternative method for examining the treatment received by workers with different characteristics is to calculate a measure of individual equity for each person in a large sample of actual case histories. These measures may then be aggregated over the set of characteristics of interest. There are three advantages to this approach. First, no *a priori* assumptions about such characteristics as age of entry into covered employment, continuity of employment, earnings levels and date of retirement are necessary. Second, the results may be displayed as complete frequency distributions of the measure of individual equity rather than a single mean (or median) value. In addition, the results may be used to evaluate the quality of the representative individual approach. That is, comparisons of results between the two approaches may uncover biases from omitted characteristics, incorrect *a priori* specifications, or the inability of the representative individual approach to accurately represent the distribution of actual results.

There are disadvantages to the individual case history approach. The most obvious is the need for an adequate sample (described below) of longitudinal microdata. Even this data base is incomplete since a full case history (including benefits as well as earnings) is only available after all benefits are paid on each worker's account. This means that the sample would be restricted to the deceased. For the problem of calculating the present value of *expected* benefits at retirement, only completed earnings histories are considered. Postretirement earnings are excluded (see section II A below) so the necessary data are available.

II. Basic Method

This section describes the method used to calculate the internal rates of return. It begins with a description of the basic data file and the sample selected for study. A method for identifying the OAI tax rate as a proportion of the total OASI tax rate is described and the actual computational procedure is presented.

A. Study Sample

Our study sample is drawn from the Social Security Administration's Continuous Work History Sample (CWHS). 1/ The CWHS contains information drawn from a number of administrative data files maintained for the operation of social security programs. The CWHS is a 1-percent random sample of all nine digit social security numbers ever issued. The specified sample digits (the last four places of the social security number) are the same each year so that longitudinal data are recorded for each individual in the sample. A special 0.1-percent subsample is maintained which contains detailed annual taxable earnings information from 1937 to date. The CWHS population covered 89.1 percent of the labor force in 1967, the first year of the subsample. Although information on total earnings is lacking, no other data base is available with this degree of completeness over time.

1/ For a description of the CWHS see the contributions by Sheldon A. Rubin and Warren Buckler in *The Labor Force: Migration, Earnings, and Growth*, (see reference).

The data sample is restricted to worker-only beneficiaries 2/ (individuals receiving benefits but with no dependents drawing benefits on that individual's account). This choice rests on the absence in the CWHS of the earnings and demographic data needed to reconstruct the life-cycle earnings patterns of couples. The sample population does, however, include the majority of new retirees. In addition, we restrict ourselves to workers retiring in the last 4 years (1967-1970) for which earnings data are available. An individual is included in the sample if:

(1) sex, race, month, and year of birth are known;

(2) benefit status changed from living, nonentitled (a living worker not entitled to any social security benefits) to living, entitled (living worker entitled to old-age benefits) between January 1 of the year of retirement and January 1 of the next year;

(3) the family benefit code in the year following retirement indicated a worker-only beneficiary; and

(4) the benefit in the year following retirement was in current-payment status.

TABLE 1.--Distribution of persons in the sample by sex, race, and year of retirement

Year of retirement	Total	White		Other races	
		Men	Women	Men	Women
Total..	2,642	1,097	1,270	132	143
1967........	651	264	319	33	35
1968........	618	251	293	32	42
1969........	676	289	326	35	26
1970........	697	293	332	32	40

Because of the effect of the earnings test, the conditions listed above have important implications for the inclusion in the sample and the treatment of aged workers with earnings. Under the earnings test the

2/ A glossary of social security program terminology may be found in the Annual Statistical Supplement to the *Social Security Bulletin*, 1974.

benefit payable to otherwise entitled workers may be reduced if the worker has current earnings. 3/ If an aged worker's current earnings were sufficient to reduce his current benefit to zero in the year following entitlement, then the worker was excluded from the sample because of the requirement that the benefit be in current-payment status. In addition, any reduction in a worker's benefit because of postretirement earnings is ignored in computing the internal rate of return because of the method adopted in this study (this relates to an assumption that the real benefit amount remains constant throughout the retirement period) (see pages 10 and 31).

B. Historical Tax Rates

To analyze OAI a series of historical tax rates were constructed isolating tax contributions for this program from survivors insurance (SI) and disability insurance (DI). 4/ Our procedure is based on the fact that OASDI is essentially on an annual pay-as-you-go basis whereby current expenditures are met by current tax revenues, and these revenues are generated by a flat-rate tax (one for old-age and survivors insurance (OASI) and one for DI) applied to the taxable earnings base. We separate OAI from OASI by decomposing the published data on net program expenditures into component subprograms and assign these component amounts to OAI or SI. An OAI annual tax rate series (see table 2) was then constructed by allocating a share of the OASI tax rate on the basis of the proportion of total OASI expenditures accounted for by the component subprograms assigned to OAI. In some of these assignments analytical considerations indicated departures from program definitions. However, disability benefits are classified as under present program definitions, so that the historical DI legislated tax rates remain unchanged and do not influence the OAI tax rate estimate.

In assigning the component subprograms, we interpret the OAI portion of OASDI as saving for retirement and the SI and DI programs as term insurance against the risk of earnings loss due to worker death or disability prior to retirement. Thus, a rate of return may be associated with OAI, whereas SI and DI primarily reflect current consumption of an insurance service. Under this interpretation the function of OAI benefits is to provide income to the worker's family unit after the worker reaches retirement age, and the function of SI and DI benefits is to provide income for the family unit during the period up to the worker's retirement

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3/ The provisions of the earnings test are detailed in *Social Security Handbook*, U.S. Department of Health, Education, and Welfare, Social Security Administration, fifth edition, February, 1974.

4/ Analysis of the separation of SI and DI tax contributions from the total OASDI tax appears in Dean R. Leimer, "Identifying Historical OAI, SI, and DI Tax Rates Under Alternative Program Definitions." (see reference).

TABLE 2.--Data for tax computation

Year	Wage and salary tax rate, t	Self-employment tax rate, t_s	Taxable maximum, M	Consumer price index, C
1937...	.0111	0	3000.	43.00
1938...	.0110	0	3000.	42.20
1939...	.0110	0	3000.	41.60
1940...	.0111	0	3000.	42.00
1941...	.0135	0	3000.	44.10
1942...	.0133	0	3000.	48.80
1943...	.0128	0	3000.	51.80
1944...	.0124	0	3000.	52.70
1945...	.0125	0	3000.	53.90
1946...	.0140	0	3000.	58.50
1947...	.0147	0	3000.	66.90
1948...	.0159	0	3000.	72.10
1949...	.0155	0	3000.	71.40
1950...	.0243	0	3000.	72.10
1951...	.0245	.0184	3600.	77.80
1952...	.0244	.0183	3600.	79.50
1953...	.0249	.0187	3600.	80.10
1954...	.0336	.0252	3600.	80.50
1955...	.0342	.0256	4200.	80.20
1956...	.0346	.0259	4200.	81.40
1957...	.0352	.0264	4200.	84.30
1958...	.0354	.0266	4200.	86.60
1959...	.0397	.0298	4800.	87.30
1960...	.0485	.0364	4800.	88.70
1961...	.0484	.0363	4800.	89.60
1962...	.0509	.0383	4800.	90.60
1963...	.0599	.0446	4800.	91.70
1964...	.0600	.0446	4800.	92.90
1965...	.0597	.0445	4800.	94.50
1966...	.0613	.0462	6600.	97.20
1967...	.0626	.0474	6600.	100.00
1968...	.0584	.0447	7800.	104.20
1969...	.0656	.0492	7800.	109.80
1970...	.0644	.0483	7800.	116.30

age if the worker's earnings are interrupted by death or disability. We have used these functional definitions in assigning OASI components to OAI so that a net OAI tax rate defined as the gross OASDI tax rate minus the tax rate associated with currently consumed SI and DI protection is calculated. As an example of the implications of these functional definitions, consider the case of an aged widow of an insured worker who died after becoming entitled to old-age benefits. Under present program definitions, benefits to dependents are reclassified as survivor's benefits after the retired insured worker dies. Under the functional definitions adopted here benefits to the aged widow of a retired worker are classified as old-age benefits.

The problem of separating the SI and DI portions of the tax has been approached by other authors in a variety of ways. Campbell and Campbell use an approach similar to ours in which the total tax is divided along functional lines. For example, both approaches interpret benefits to surviving spouses of old-age decedents as OAI benefits. However, the approaches differ in that Campbell and Campbell interpret benefits to aged surviving spouses of workers who died prior to reaching retirement as SI benefits, while such benefits are considered as OAI benefits under the definitions adopted here. Since approximately one-third of those who start working in their early 20s do not live to age 65, Campbell and Campbell assume that two-thirds of the survivor benefits paid to aged widows are paid to widows of workers who live to retirement. The remainder of survivor's benefits plus disability benefits are then estimated to be 20 percent of total OASDI benefits. Campbell and Campbell implicitly assume that this percentage is constant over time and estimate the OAI tax rate as 80 percent of the OASDI tax rate. Since a constant proportion is assumed, this approach ignores changes in the relative sizes of the various programs over time. This approach also ignores trust fund receipt and expenditure flows other than cash benefit payments. Okonkwo, who reports results for both the OASDI and OAI tax rates, uses the 20-percent figure as well. However, his choice is rationalized on the basis of an "official" Social Security Administration estimate. 5/ Neither Aaron nor Chen and Chu state clearly the tax rate assumption used. In some tables, Aaron includes the expected survivor benefits to the survivors of nonaged workers, but he uses the OASI tax rate throughout. Chen and Chu use the OASI tax rate but compute the cost-benefit ratios and rates of return for new entrants considering retirement benefits alone. The separation of SI and DI is not relevant to Brittain's analysis since the tax rate for OAI is calculated each year as the tax rate required to equate aggregate taxes and old-age retirement benefits under his economic and demographic assumptions.

5/ See testimony by Robert J. Myers before the House Ways and Means Committee, (see reference).

C. Calculation of Internal Rates of Return

Referring to the definitions of the terms if equations (1) and (2) the actual expression used to calculate the real internal rate of return is:

$$f(R) = \sum_{i=1}^{i'} \left(\frac{T_i}{C_i}\right)(1+R)^{i'-i+1} - \sum_{i=i'+1}^{i''} S_i \left(\frac{B_i}{C_i}\right)(1+R)^{i'-i+1} = 0 \quad (3)$$

where

C_i = Consumer Price Index in year i; and

i'' = year in which retiree attains age 101.

For computational simplicity, we assume that $\frac{B}{C}$ remains constant over time. Since the real benefits of 1967 to 1970 retirees have actually increased since their retirement dates, this assumption introduces a downward bias in our estimates of R. 6/

The calculation of annual tax payments is fairly straight forward once a decision about the incidence of the employer share of the tax is made. It is common if not universal to assume that the employer share is actually borne by the worker in the form of lower wages. 7/ All of the authors cited adopt this convention. The actual OAI tax rates used along with other necessary data are in table 2.

Using these data, taxes are computed from the CWHS annual earnings information according to the following scheme. For the years before 1951 (social security taxes were first collected in 1937), $T_i = t_i W_i$, where t_i = combined employee-employer tax rate in year i-and W_i = taxable wages in year i. If wages exceeded the maximum taxable earnings base, M_i, only the employer's contribution is included for earnings above the base. Note that the tax rate used assumes 100 percent backward shifting of the payroll tax. Therefore, the tax paid on wages above the base represents the nonrefundable employer contribution. So,

$$T_i = t_i M_i + (1/2)t_i(W_i - M_i).$$

6/ The internal rate of return was calculated using Mueller's iterative method as described in G. K. Kristiansen (1963), (see reference). The actual computer routine used is RTMI from the I.B.M. *Scientific Subroutine Package*.

7/ The most recent challenge to this assumption is by Martin S. Feldstein (1974) who finds that the effect of the tax on capital formation and therefore worker productivity puts the issue in question (see reference).

Between 1951 and 1954 three possibilities existed. First, if total earnings, equal to wages (W) plus self-employment income (I), were less than the earnings base (M), then

$$T_i = t_i W_i + t_{si} I_i,$$

where t_{si} is the tax rate on self-employment income in year i. Second, if total earnings exceeded the earnings base but total wages did not, then taxes equaled the tax rate times wages plus the self-employment tax rate times the difference between the base and wages; that is,

$$T_i = t_i W_i + t_{si} (M_i - W_i).$$

Finally, if total wages exceeded the base, taxes equaled the tax rate times the base plus one-half the tax rate times the difference between wages and the base. So,

$$T_i = t_i M_i + (1/2) t_i (W_i - M_i).$$

After 1955, total wages were the sum of wages and farm wages. The computation is then the same as for 1951-54.

Next, the individual's primary insurance amount (PIA) was computed on the basis of his or her prior taxable earnings history. There are three types of formulae which apply to the people in the sample: the usual PIA formula applicable at the date of retirement, the 1967 old-start formula, and the 1965 old-start procedure. We used the highest PIA calculated from the three formulae, consistent with present program provisions. 8/

The monthly benefit of a worker-only beneficiary may differ from the PIA for two reasons. First, the worker may have earnings above the level set by the retirement test. The benefit would then be reduced. Also, the worker may have retired before attaining age 65, causing an actuarial reduction in the monthly benefit amount to be imposed. The first possibility is not considered in this paper.

A series of survivor probabilities is needed to calculate expected benefits. We used a set of age-specific probabilities based on Social Security Administration data (see Francisco Bayo (1972)). These rates, which are

8/ Under present law the PIA is computed using a table which lists the PIA associated with each possible benefit base (average monthly earnings or AME) as computed from the individual's prior taxable earnings history. However, this PIA table can be closely approximated by a formula relating the PIA as a function of the AME. For details of the benefit computation procedure, see *Social Security Handbook*, U.S. Department of Health, Education, and Welfare, Social Security Administration, fifth edition, February 1974, sections 701-713.

available disaggregated by sex and race, are shown in table 3. This level of disaggregation is between Campbell and Campbell's use of a single value of 14 years for life expectancy and the elaborate mortality differentials for sex, race, income and educational level, and marital status adopted by Aaron and Okonkwo. 9/

III. Results

The results are presented in two forms. First, the average internal rates of return are displayed in tabular form. Then a regression analysis which seeks to isolate the effects of various worker characteristics is described. In both the tabular displays and the regression analysis individuals were classified according to a measure of their relative position in the distribution of lifetime earnings (para. A).

A. A Measure of Lifetime Earnings

For comparing rates of return for workers at various points in the distribution of lifetime earnings, it is advantageous to represent an individual's lifetime earnings stream before retirement by a single number. This suggests that all of the factors distinguishing the earnings histories of workers can be summarized meaningfully into a single measure. While far from perfect in this regard, the present value at retirement of each worker's prior real earnings is one useful possibility.

The measure of lifetime earnings adopted was the accumulated value of annual taxable real earnings, henceforth denoted by the mnemonic ACERN. This number was computed as follows:

(1) all earnings for each year are received by the worker on the first day of that year and;

(2) no earnings are generated in the year of retirement or later.

Under these assumptions, the present value of the worker's lifetime real taxable earnings at the beginning of the year of retirement is:

$$E = \sum_{i=1}^{i'} \frac{W_i}{C_i} \left[\prod_{j=i}^{i'} (1+r_j) \right] \qquad (4)$$

where the time subscripts i and i' are as in equation (1) and

E = accumulated value of lifetime taxable real earnings (ACERN),

W_i = annual taxable earnings in year i, and

r_j = appropriate annual interest rate in year j. 10/

9/ The primary source for disaggregated mortality differentials is Kitagawa and Hauser (1973), (see reference).

10/ A more complete description of ACERN along with listings of the basic data used is available from the authors on request.

TABLE 3.--Survivor probabilities 1/

Age	White		Other races	
	Men	Women	Men	Women
62...	.97466	.98910	.97301	.98529
63...	.97244	.98806	.97073	.98376
64...	.97003	.98689	.96823	.98203
65...	.96742	.98557	.96558	.98018
66...	.96528	.98464	.96148	.97737
67...	.96207	.98259	.95772	.97464
68...	.95882	.98052	.95397	.97192
69...	.95549	.97836	.95024	.96921
70...	.95201	.97606	.94650	.96645
71...	.94833	.97354	.94268	.96356
72...	.94440	.97073	.93870	.96045
73...	.94018	.96757	.93451	.95708
74...	.93560	.96401	.93004	.95342
75...	.93061	.96001	.92527	.94943
76...	.92518	.95552	.92022	.94511
77...	.91929	.95049	.91488	.94049
78...	.91289	.94485	.90925	.93557
79...	.90593	.93855	.90326	.93042
80...	.89836	.93154	.89690	.92504
81...	.89018	.92381	.89015	.91941
82...	.88131	.91532	.88309	.91353
83...	.87172	.90605	.87574	.90733
84...	.86144	.89597	.86803	.90078
85...	.85043	.88507	.86000	.89376
86...	.83865	.87334	.85183	.88628
87...	.82610	.86086	.84357	.87843
88...	.81276	.84774	.83502	.87026
89...	.79861	.83414	.82626	.86181
90...	.78389	.82005	.81773	.85341
91...	.76880	.80551	.80995	.84531
92...	.75358	.79050	.80329	.83785
93...	.73865	.77522	.79782	.83118
94...	.72419	.75987	.79349	.82519
95...	.71002	.73031	.79020	.81929
96...	.69570	.71678	.78780	.81277
97...	.68189	.70438	.78578	.80543
98...	.66897	.69313	.78296	.79758
99...	.65743	.68316	.77940	.78979
100...	.64690	.67395	.77496	.78227
101...	.63610	.67395	.76960	.77523

1/ Probability of surviving from age k to age $k+1$.

The percentage distribution of ACERN in the sample is shown in table 4. ACERN is an indication of each individual's human wealth. it differs from the sum of annual earnings or a simple average of annual earnings in that each year's earnings are weighted by a factor which reflects the opportunity cost of time. The choice of an appropriate opportunity cost of time is subject to the same problems raised in computing cost-benefit ratios. Since our primary interest is the present value of lifetime earnings if invested as earned, the yield on government securities and the average return on equity shares likely represent the lower and upper bounds of the appropriate interest rate series. The historical mean of the annual arithmetic averages of the two rates over the period 1937-69 has arbitrarily been selected as the interest rate used to accumulate lifetime earnings. Also, since earnings are to be deflated by the consumer price index, the interest rate is converted to real terms.

Problems were encountered in applying even this simplified formulation to individual workers. A primary problem was the lack of complete data on individual earnings histories. The data file used in this analysis, the 0.1 percent CWHS, contains information on annual *taxable* earnings from 1937. However, the specifications of the taxable earnings base and the types of earnings covered each year are policy variables which affect the pattern of internal rates of return over the distribution of lifetime *earnings*. One purpose of this analysis is to discern what effect past policy has had on this pattern. Hence, the use of accumulated taxable earnings as a proxy for accumulated earnings is not completely satisfactory.

The 0.1 percent CWHS also contains information on annual *estimated* earnings for each individual from 1956. 11/ However, this period represents only a relatively short span in the latter portion of the working lives for the cohorts considered in this analysis. Further, the statistical properties of these estimates are unknown. 12/ Because of these deficiencies, the measure of accumulated lifetime earnings employed in this analysis is based on annual taxable earnings since 1937.

Another problem related to the longitudinal earnings data in the 0.1 percent CWHS is that reported self-employed net income includes some component which is a return to capital rather than earnings. 13/ Hence,

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11/ These are the so-called "Method II" estimates based on individual quarterly wage data up to the taxable earnings base. For a description of the estimating procedure, see *The 1 percent Longitudinal Employee-Employer Data File*, Office of Research and Statistics, Social Security Administration, November 1971.

12/ Work is currently underway to determine how good the Method II estimates are by comparison with IRS data.

13/ There are other problems as well. For example, self-employed net income is not reported for workers who also have wage income equal to or exceeding the taxable earnings base.

TABLE 4.--Percentage distribution of ACERN 1/ 2/

ACERN (in thousands)	Total	White		Other races	
		Men	Women	Men	Women
0-18.6............	13.1	5.9	15.9	17.6	39.9
18.7-37.3.........	12.5	5.6	17.9	12.2	18.1
37.4-55.9.........	10.5	6.7	13.9	7.6	13.8
56.0-74.5.........	9.6	5.9	12.5	14.5	9.4
74.6-93.1.........	7.5	5.2	9.8	5.3	6.5
93.2-111.7........	6.1	5.1	7.5	3.1	3.6
111.8-130.3.......	4.8	3.9	5.9	3.8	2.9
130.4-148.9.......	5.2	6.9	3.9	6.1	2.2
149.0-167.5.......	3.3	4.0	2.9	3.1	1.4
167.6-186.1.......	3.1	3.7	2.8	2.3	.7
186.2-204.7.......	3.6	5.8	1.7	6.9	.7
204.8-223.3.......	3.5	6.0	1.5	5.3	0
223.4-241.9.......	3.1	5.7	1.0	3.1	.7
242.0-260.5.......	3.1	6.1	1.0	1.5	0
260.6-279.1.......	4.0	7.9	.9	5.3	0
279.2-297.7.......	3.1	6.5	.6	.8	0
297.8-316.3.......	1.[illegible]	4.1	.2	1.5	0
316.4-334.9.......	1.1	2.5	.1	0	0
335.0-353.5.......	.5	1.3	0	0	0
353.6 +...........	.5	1.3	0	0	0

1/ Totals may not add to 100 due to rounding.
2/ This table excludes 30 workers with no or very low earnings.

the accumulated lifetime earnings measure is biased upward for workers with self-employment net income. Whether this alters the pattern of internal rates of return over the distribution of the lifetime earnings measure employed depends on several factors. Social security tax rates are lower for self-employment income than for wage and salary earnings. 14/ This might be rationalized on two grounds: (1) the return to capital component of self-employment income; and (2) the extent to which the employer's share of the tax is not completely shifted backward to the employee. In any case, it is highly unlikely that the ratio of the self-employment tax rate to the employee tax rate has consistently compensated for these two factors. Consequently, the mix of self-employment and wage income for each individual may alter the pattern of internal rates of return over the distribution of the lifetime earnings measure employed in this analysis. In an attempt to control for this influence, an additional variable was introduced defined as the proportion of the lifetime earnings measure which reflects self-employment net income (SE/TX).

B. Tabular Results

Since there is no simple and obvious way of displaying the results, a detailed set of tabular arrays (see appendix) have been prepared which are summarized in tables 5 and 6. These tables present average rates of return and average rates of return relative to the mean rate of return for the entire sample. The distribution of accumulated earnings for all persons in the sample is divided at the quartile points of \$36,200, \$83,300, and \$181,100. The results are reported for only 2,612 of the original 2,642 individuals in the sample. The remaining 30 persons had no or very low taxable earnings so that their rates of return are infinite or very large. These workers received benefits under provisions of the law granting benefits to workers who would not otherwise be covered under OAI. For workers aged 72 before 1968, no quarters of coverage, and therefore no taxable earnings, were required to qualify. After 1968, the number of quarters required was minimal. The numbers of these workers (referred to as special age-72 beneficiaries) have been indicated where appropriate. The percentage distribution of the natural logarithm of the rate of return (ROFR) is presented in table 7.

The results in tables 5 and 6 indicate a substantial reduction in rates of return as accumulated earnings increase. For the full sample, the average rate of return for workers in the first (or lowest) earnings quartile exceeded the mean by 70 percent. The average was about equal to the mean in the second quartile, and 24 percent and 43 percent below the mean in the third and fourth quartiles respectively. This result is

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14/ The ratio of the OASI self-employment income tax rate to the combined employee-employer tax rate averaged about .747 over the period 1951-74, ranging from a low of .707 in 1974 to a high of .765 in 1968.

TABLE 5.--Rates of return

Age at retirement and accumulated lifetime earnings quartile 1/	All cohorts			Men				Women			
	All	Men	Women	1967	1968	1969	1970	1967	1968	1969	1970
All ages											
Total	14.80	11.67	17.57	13.18	12.14	10.95	10.61	19.25	18.51	16.97	15.74
1	25.22	21.93	26.30	24.40	21.14	20.04	20.61	26.72	28.93	26.31	23.18
2	14.40	14.22	14.48	15.56	14.92	13.71	12.71	15.29	14.57	14.05	14.05
3	11.19	10.74	11.56	10.66	11.51	10.52	10.33	11.69	12.13	11.29	11.33
4	8.41	8.24	9.39	8.48	8.54	7.96	8.11	9.94	9.52	9.09	9.11
Age 62-64											
Total	14.15	11.82	15.90	13.27	12.52	10.99	10.70	17.49	16.13	15.38	14.74
1	21.74	21.16	21.91	23.99	20.90	18.87	19.18	22.82	22.45	21.65	20.43
2	13.83	13.81	13.85	14.78	14.56	13.47	12.48	14.33	14.30	13.46	13.34
3	10.85	10.46	11.17	10.23	11.47	10.27	10.13	11.06	11.37	11.22	11.05
4	8.10	7.94	9.03	8.19	8.14	7.73	7.79	9.59	9.07	8.86	8.88
Age 65											
Total	13.19	10.74	16.79	11.97	10.86	10.17	10.14	18.59	18.94	15.63	14.65
1	27.34	23.09	29.01	24.61	20.82	21.11	23.49	31.55	33.60	29.40	22.26
2	16.64	15.95	17.02	17.76	16.95	14.90	13.73	17.68	16.19	16.71	16.96
3	11.90	11.34	12.38	11.68	11.62	11.00	11.01	12.94	13.96	11.54	11.84
4	8.73	8.56	9.77	8.79	8.97	8.26	8.39	10.05	10.37	9.47	9.35
Age 66 and over											
Total	30.06	17.00	36.98	19.93	15.97	15.70	15.72	37.37	42.45	40.87	28.73
1	41.73	24.41	48.03	26.04	22.34	23.82	24.34	42.40	66.61	52.02	37.24
2	15.98	13.79	16.80	12.67	14.70	11.26	-	19.40	15.68	17.13	16.32
3	11.33	10.73	11.92	10.68	11.07	10.65	9.94	12.01	13.66	10.94	11.13
4	8.89	8.41	10.32	9.24	8.82	7.64	9.04	11.08	9.94	-	-
Source table	A-1	A-2	A-3	A-8	A-9	A-10	A-11	A-12	A-13	A-14	A-15

1/ The quartiles are arranged in ascending order; thus, quartile one is the lowest quartile.

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TABLE 6.--Relative rates of return

Age at retirement and accumulated lifetime earnings quartile	All cohorts			Men				Women			
	All	Men	Women	1967	1968	1969	1970	1967	1968	1969	1970
All ages											
Total	1.00	.79	1.19	.89	.82	.74	.72	1.30	1.25	1.15	1.06
1	1.70	1.48	1.78	1.65	1.43	1.35	1.39	1.81	1.95	1.78	1.57
2	.97	.96	.98	1.05	1.01	.93	.86	1.03	.98	.95	.95
3	.76	.73	.78	.72	.78	.71	.70	.79	.82	.76	.77
4	.57	.56	.63	.57	.58	.54	.55	.67	.64	.61	.62
Age 62-64											
Total	.96	.80	1.07	.90	.85	.74	.72	1.18	1.09	1.04	1.00
1	1.47	1.43	1.48	1.62	1.41	1.28	1.30	1.54	1.52	1.46	1.38
2	.93	.93	.94	1.00	.98	.91	.84	.97	.97	.91	.90
3	.73	.71	.75	.69	.78	.69	.68	.75	.77	.76	.75
4	.55	.54	.61	.55	.55	.52	.53	.65	.61	.60	.60
Age 65											
Total	.89	.73	1.13	.81	.73	.69	.69	1.26	1.28	1.06	.99
1	1.85	1.56	1.96	1.66	1.41	1.43	1.59	2.13	2.27	1.99	1.50
2	1.12	1.08	1.15	1.20	1.15	1.01	.93	1.19	1.09	1.13	1.15
3	.80	.77	.84	.79	.79	.74	.74	.87	.94	.78	.80
4	.59	.58	.66	.59	.61	.56	.57	.68	.70	.64	.63
Age 66 and over											
Total	2.03	1.15	2.50	1.35	1.08	1.06	1.06	2.53	2.87	2.76	1.94
1	2.82	1.65	3.25	1.76	1.51	1.61	1.64	2.86	4.50	3.51	2.52
2	1.08	.93	1.14	.86	.99	.76	-	1.31	1.06	1.16	1.10
3	.77	.73	.81	.72	.75	.72	.67	.81	.92	.74	.75
4	.60	.57	.70	.62	.60	.52	.61	.75	.67	-	-

TABLE 7.--Percentage distribution of LOG (ROFR) 1/ 2/

LOG(ROFR)	Midpoint of interval for ROFR (%)	Total	White		Other races	
			Men	Women	Men	Women
1.63-1.82	5.60	--	0.1	0	0	0
1.83-2.02	6.81	3.7	8.6	0	2.3	0
2.03-2.21	8.27	18.3	37.3	3.5	19.1	0
2.22-2.41	10.04	19.3	20.9	18.8	23.7	7.2
2.42-2.60	12.21	19.0	11.3	25.6	24.4	14.5
2.61-2.80	14.84	15.5	8.7	21.1	9.9	24.6
2.81-3.00	18.03	10.2	5.8	13.4	8.4	18.1
3.01-3.19	21.91	6.4	4.1	7.3	5.3	17.4
3.20-3.38	26.60	3.1	1.5	4.2	3.8	4.3
3.39-3.58	32.33	1.7	.8	2.2	2.3	4.3
3.59-3.77	39.29	.7	.5	.8	0	2.9
3.78-3.97	47.75	.6	.3	.6	.8	2.9
3.98-4.16	57.97	.4	.1	.7	0	.7
4.17-4.36	70.46	.4	0	.7	0	1.4
4.37-4.55	85.63	.2	.1	.3	0	0
4.56-4.75	104.06	.2	0	.3	0	0
4.76-4.94	126.34	.1	0	.2	0	.7
4.95-5.14	153.55	--	0	.1	0	0
5.15-5.33	186.61	--	0	.1	0	0
5.34 +	226.78	.1	0	.1	0	.7

1/ Totals may not add to 100 due to rounding.
2/ This table excludes 30 workers with rates of return exceeding 500%.
-- less than 0.1%.

consistent with what we belive to be the intent of the law, but the mechanism used operationally, the concave relation between benefit amounts and benefit bases, 15/ may imperfectly translate legislative intent into actual outcomes. Therefore, at this stage our analysis is limited to the purely positive aspects of measuring how the system treats various individuals. We are not testing hypotheses here nor are we attempting to establish whether various groups of workers are treated "fairly" or "unfairly" under the present benefit structure. 16/

The decline in rates of return with increases in accumulated earnings is similar qualitatively across cohorts but the distribution has changed somewhat. This is shown in table 8, where average rates of return by accumulated earnings quartile are displayed as ratios to the overall sex-retirement cohort specific mean (see appendix tables A-16 through A-23 for the basic data). Here we are concerned with the distribution of earnings within the cohort so the accumulated taxable earnings quartiles are also sex-cohort specific. *Ceteris paribus*, a narrowing of the difference between each ratio and unity suggests that the distribution of rates of return by lifetime taxable earnings has also narrowed. 17/ This appears to be the case but the changes from 1967 to 1970 are small and lack uniformity from year to year.

A second obvious feature of the data displayed in the appendix tables is the decline in the coefficients of variation between the successively higher lifetime earnings quartiles. This relationship is illustrated

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15/ The actual computation of benefit amounts is done in several stages. First, a benefit base is computed for each worker entitled to benefits. The benefit base is an unindexed average of each worker's prior taxable earnings currently taken over a period of about 20 years. A benefit amount for each worker is then determined from a table relating benefit amounts to the benefit base. This table is divided into segments such that increments to the benefit amount generally rise by less than increments to the benefit base. Therefore, the average benefit rate (the ratio of the benefit amount to the benefit base) falls as the benefit base increases. In general, then, a concave relationship exists between the benefit amount and the measure of prior earnings represented by the benefit base. The benefit computation procedure is explained in the *Social Security Handbook*, U.S. Department of Health, Education, and Welfare, Social Security Administration, fifth edition, February 1974.

16/ For an analysis of the equity of alternate benefit structures, see our paper, A Framework for Analyzing the Equity of the Social Security Benefit Structure, (see reference).

17/ Under the assumption that the relevant discount rate (which reflects the opportunity cost of tax payments) does not vary by earnings class, the movement of these ratios toward unity between successive cohorts would imply that the system had a smaller relative redistributional impact over time.

TABLE 8.--Rates of return relative to sex-cohort specific averages

Accumulated lifetime earnings quartile	Men				Women			
	1967	1968	1969	1970	1967	1968	1969	1970
1..................	1.72	1.48	1.56	1.49	1.69	1.78	1.73	1.58
2..................	.98	1.07	.98	.98	.97	.87	.91	.96
3..................	.69	.78	.81	.81	.76	.75	.76	.81
4..................	.62	.67	.71	.71	.58	.59	.59	.65
Sex-cohort specific average...............	13.18	12.14	10.95	10.61	19.25	18.51	16.97	15.74
Source table..........	A-16	A-17	A-18	A-19	A-20	A-21	A-22	A-23

directly in table 9 below for the various sex and age at retirement groups. We attribute this decline to the relationship between accumulated earnings and benefit amounts. Suppose a worker has very low earnings. It is likely that he qualifies for the minimum benefit. However, there are many earnings histories which qualifies an individual for the minimum, so a great deal of variation is expected in the rates of return for workers with low benefit amounts and low accumulated earnings. On the other hand, there is only one taxable earnings history (earnings at the maximum taxable earnings base in each year) which qualifies a worker for the maximum benefit. Thus less variation in lifetime earnings and rates of return is expected within the highest earnings quartile. This explanation is not meant to be rigorous but it does illustrate the potential importance of examining the underlying distributions of lifetime earnings, rather than relying on aggregate measures.

The most striking result of this analysis is the extremely high rates of return calculated for workers retiring after age 65 and with low earnings. As shown in tables 5 and 6, the average rates of return for this group are very high, ranging up to 450 percent (for women retiring in 1968) of the overall mean. Much of this is due to the inclusion of special age-72 beneficiaries in the sample.

It may be that special age-72 benefits constitute a program provision which is conceptually different from the basic intent of the OAI program. That is, it might be argued that such benefits should not be viewed as earnings replacement "earned" by the worker while employed but rather as a pure transfer. However, similar arguments could be offered for the minimum benefit provision or any transfer in excess of *quid pro quo* as well, so these workers have not been excluded from the sample.

The actuarial reduction for early retirement is among the program provisions which can be evaluated using our technique. For workers retiring before age 65, the monthly benefit amount is reduced five-ninths of 1 percent for each month of entitlement before age 65. 18/ This reduction is intended to equate the total actuarial value of benefits received regardless of age at retirement. If rates of return differ by age at retirement, then either the actuarial reduction is too large or too small in an *ex post* sense or the operation of some factor is not explicitly accounted for. 19/ We examined the latter possibility. The columns of tables 5 and 6 displaying relative rates of return by sex for all cohorts combined indicate that the actuarial reduction may be too large. The ratio of the average rate of return for workers retiring at age 65 to the equivalent measures for workers retiring before age 65 is:

18/ As of 1970, there was no provision for increasing benefits for late retirement. However, such a provision is part of the current law.

19/ Note that we measure the effect of the reduction *ex post*, that is, at the date of retirement rather than *ex ante* when the decision to retire is being made.

TABLE 9.--Coefficients of variation (V) of average rate of return

Age at retirement and accumulated lifetime earnings quartile	All		Men		Women	
	V	Number of cases	V	Number of cases	V	Number of cases
All ages						
Total............	.84	2612	.50	1225	.89	1387
1....................	.84	653	.42	161	.90	492
2....................	.21	653	.22	210	.20	443
3....................	.17	653	.16	297	.16	356
4....................	.11	653	.10	557	.08	96
Age 62-64						
Total............	.58	1764	.51	758	.58	1006
1....................	.56	478	.45	113	.59	365
2....................	.19	516	.21	163	.18	353
3....................	.16	431	.18	194	.14	237
4....................	.10	339	.09	288	.07	51
Age 65						
Total............	.61	698	.42	415	.62	283
1....................	.53	85	.34	24	.56	61
2....................	.20	115	.22	41	.19	74
3....................	.16	196	.13	90	.17	106
4....................	.10	302	.09	260	.06	42
Age 66 and over						
Total............	1.23	150	.54	52	1.18	98
1....................	1.05	90	.35	24	1.03	66
2....................	.22	22	.24	6	.20	16
3....................	.18	26	.10	13	.21	13
4....................	.14	12	.12	9	.09	3
Source table..........	A-1		A-2		A-3	

Accumulated lifetime earnings quartile	Men	Women
1..................	1.091	1.324
2..................	1.161	1.223
3..................	1.085	1.120
4..................	1.074	1.082

Roughly correcting for differences in accumulated earnings, the average rates of return are higher for workers retiring at age 65. This difference is greater for women than for men. Of course, much of this difference may be due to our use of survivor probabilities disaggregated only by sex. In later work, we will further disaggregate these probabilities to see if any other unintended effects are empirically important.

Another interesting result is the apparent decline in rates of return by cohort. In table 6 it is shown that the relative rate of return for all men declines from .89 in 1967 to .72 in 1970; for women this decline is from 1.30 to 1.06. The pattern of this change does not, however, remain constant when the data are disaggregated by earnings. Therefore, a number of factors may have combined to generate the aggregate result as demonstrated below.

C. Regression Results

We would like to isolate the effect of particular indentifiable worker characteristics on the rate of return. Regression analysis is a statistical technique which can be used to identify the partial effect of each particular worker characteristic on the rate of return while holding all other worker characteristics constant. Therefore, we computed the regression of the rate of return on variables for sex, race, age at retirement and year of retirement as well as the labor force experience variables for accumulated lifetime taxable earnings, the proportion of accumulated lifetime taxable earnings from self-employment, age at entry into covered employment, and number of years in covered employment. Tables 10 and 11 describe these variables. The variables for sex, race, age at retirement, and year of retirement are dummy variables taking the value one for an individual when the characteristic is true and zero otherwise.

The choice of a functional form was based on the evidence shown on chart 1. Here, the natural logarithm of the rate of return (ln ROFR) is plotted against the natural logarithm of lifetime accumulated taxable earnings (ln ACERN). Since this relation is approximately linear (and the relation between ROFR and ACERN is not) we adopted the following specification for the relation between the rate of return for the i^{th} individual and the explanatory variables:

$$\ln ROFR_i = a_0 + a_1 \cdot \ln ACERN_i + \sum_{J=2}^{12} a_j \quad X_{ij} \qquad (5)$$

TABLE 10.—Regression of rate of return, definitions of variables

Variable	Description
ACERN	Accumulated value of lifetime taxable earnings (in thousands)
SEX	Dummy variable for sex: 0 for man, 1 for woman
RACE	Dummy variable for race: 0 for white, 1 for other than white
AGE 62-64	Dummy variable for age at retirement: 1 for age 62-64, 0 otherwise
AGE 66-71	Dummy variable for age at retirement: 1 for age 66-71, 0 otherwise
AGE 72+	Dummy variable for age at retirement: 1 for age 72 or over, 0 otherwise
CHRT 68	Dummy variable for year of retirement: 1 for 1968, 0 otherwise
CHRT 69	Dummy variable for year of retirement: 1 for 1969, 0 otherwise
CHRT 70	Dummy variable for year of retirement: 1 for 1970, 0 otherwise
AGEENT	Age at entry into covered employment: age in first year of nonzero covered earnings
SERLEN	Service length: number of years with nonzero covered earnings
SE/TX	Self-employment taxable income as a proportion of total taxable earnings; i.e., ratio of accumulated value of self-employment taxable earnings to ACERN 1/

1/ This ratio reflects only the portion of self-employment net income which is taxable. For example, suppose a worker's wages and salaries were $7,000 and his self-employment income were $6,000 in a year with a maximum taxable earnings base of $10,000. Then only $3,000 of his self-employment net income would be counted when computing SE/TX.

TABLE 11.--Regression of rate of return, summary statistics of variables

Variable	Mean	Standard deviation	Coefficient of variation
1. ln(ACERN).......	4.26	1.16	0.272
2. SEX.............	.531	.499	.940
3. RACE............	.103	.304	2.95
4. AGE 62-64.......	.675	.468	.693
5. AGE 66-71.......	.043	.202	4.70
6. AGE 72 +........	.015	.121	8.07
7. CHRT 68.........	.233	.423	1.82
8. CHRT 69.........	.257	.437	1.70
9. CHRT 70.........	.266	.442	1.66
10. AGEENT.........	37.2	7.53	.202
11. SERLEN.........	20.5	8.69	.424
12. SE/TX..........	.090	.250	2.78
13. ln(ROFR).......	2.56	.442	.173
14. ACERN..........	114.2	93.2	.816
15. ROFR...........	14.8	12.4	.838

where the X_{ij} are the other explanatory variables listed in table 10. Using this form, a_1 is the partial derivative of the natural log of ROFR with respect to the natural log of ACERN, and since

$$\frac{\partial \ln \text{ROFR}}{\partial \ln \text{ACERN}} = \frac{\partial \text{ROFR}}{\partial \text{ACERN}} \cdot \frac{\text{ACERN}}{\text{ROFR}} \quad ,$$

an estimate of a_1 is an estimate of the percentage change in the rate of return with respect to a given percentage change in accumulated lifetime taxable earnings, holding all other explanatory variables constant. The interpretation of the coefficients of the dummy variables can be seen from the following simplified example. Let $\ln y_i = a+b\ x_i$ where y is some dependent variable and x_i is a dummy variable taking the value one if a particular characteristic (female, for example) is true for the i^{th} individual. Suppose the characteristic is not true for individual m and it is true for individual n.

Then

$$\ln y_m = a \quad , \text{ and}$$

$$\ln y_n = a + b \quad .$$

Therefore,

$$y_m = e^a \quad , \text{ and}$$

$$y_n = e^{a+b} \quad ; \text{ therefore}$$

$$\frac{y_n - y_m}{y_m} = \frac{e^{a+b} - e^a}{e^a} = e^b - 1 \; .$$

Thus, the proportional change in y when the characteristic holds $(x=1)$ compared with the value of y when the characteristic does not hold $(x=o)$ is $e^b - 1$. The expression for the percentage change in the dependent variable when a dummy variable changes can be simplified further using the fact that for any small number z, $\ln(1+z) \approx z$. This implies that

$$1 + z \approx e^z \quad , \text{ so}$$

$$z \approx e^z - 1 \quad .$$

The estimated regression coefficients of the dummy variables (a_j) are all small, so the estimated a_j $(j = 2,\ldots,9)$ represent the expected value of the percentage difference in the rate of return for each characteristic holding all other factors constant. 20/ For the continuous variables AGEENT, SERLEN and SE/TX the estimated coefficients represent the partial derivative of the natural logarithm of ROFR with respect to the levels of the variables. For example, since

$$a_{10} = \frac{\partial \ln \text{ROFR}}{\partial \text{AGEENT}} \quad ,$$

a_{10} times the mean of AGEENT is the estimated percentage change in ROFR with respect to a given percentage change in AGEENT evaluated at the mean of AGEENT. 21/

The results of the regression analysis appear in table 12. Before discussing these results note that two statistical problems, multicollinearity among the labor force experience variables (ACERN, AGEENT, SERLEN and SE/TX) and heteroscedasticity, were evident in the data. At present, there is no way to deal with the multicollinearity, but it is expected to be less of a problem in future analysis of more diverse data bases. In any case, the present sample was large enough so that useful results were obtained. Also, a correction for heteroscedasticity was investigated, but since the transformation used did not alter the parameter estimates significantly it is not reported.

The interpretation of most of the coefficients in the regression is straightforward. Looking at the dummy variables, women can be expected to have a rate of return 8.76 percent higher than men (this is 8.76 percent, not 8.76 percentage points). Since earnings and other factors are being held constant, this difference is primarily due to differences in survivor probabilities. Differences in these probabilities by *race* are smaller than the differences by sex, and the sign of the difference changes at age 82 for men (see table 3). That is, the probability of surviving from age 81 to age 82 is higher for white men than for all other men, but the differential reverses at higher ages. Thus, controlling

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20/ Actually, 100 a_j is the percentage change.

21/ The ratio of the percentage change in the dependent variable to the percentage change in an independent variable is referred to as an elasticity.

TABLE 12.--Regression of rate of return, regression results

Variable	Coefficient	|t|	Elasticity at mean
1. ln(ACERN).........	-.278	66.2	---
2. SEX..............	.0876	15.7	---
3. RACE.............	-.0188	2.25	---
4. AGE 62-64.........	-.0453	7.53	---
5. AGE 66-71.........	-.0290	2.19	---
6. AGE 72+...........	-.439	19.8	---
7. CHRT 68...........	.0227	3.20	---
8. CHRT 69...........	-.0176	2.53	---
9. CHRT 70...........	-.00474	.68	---
10. AGEENT............	.0244	53.4	.907
11. SERLEN............	.00558	10.1	.114
12. SE/TX.............	.180	16.7	.016
CONSTANT..........	2.70	---	---
R^2...............	.960	---	---
S.E.E.............	.125	---	---
F.................	2521.	---	---

for other variables, we expected the effect of the other than white variable to be small, as is the case. 22/

The coefficients of the *age at retirement* variables are interesting because they are all negative. This suggests that given earnings, and other factors held constant, a worker receives the highest rate of return by retiring at age 65. Two factors contribute to this result. First, *ex post* the actuarial reduction for early retirement given the survivor probabilities is too large 23/ and the lack of an actuarial increase for late retirement reduces a worker's rate of return substantially if he retires after age 65. These results are obtained holding accumulated earnings and other labor force variables constant; thus, when we introduce more elaborate differentials in survivor probabilities at a later date, the aggregate results are not expected to change.

22/ The negative sign of the other than white variable is explained by the differentials in the probability of survival from retirement to some advanced age. For women these probabilities are always higher for whites than for other races. Note that if S_k is the probability of surviving from age k to age $k+1$ then the probability of surviving from age k to age $k+t$ is

$$\prod_{i=k}^{k+t-1} S_i$$

For men, these probabilities are lower for whites after about age 90 but the contribution of benefits at age 90 and above to the present value of expected benefits at retirement is very small. For example, the present value of the average annual benefit ($1,047) at age 90 with an average rate of return (14.8 percent) for other than white man is only 7 cents higher than for a 'ite man.

23/ This can be shown directly by comparing the present values of expected benefits for two workers differing only by age at retirement. We have done this for white male workers with a PIA of $1,000 per year and an average rate of return (14.8 percent). The present value of expected benefits for the worker retiring at age 62 is substantially lower than that for the worker retiring at age 65. This helps explain the regression result. However, the actuarial reduction specified by the law, must be computed *ex ante*. The proper *ex ante* comparison is between the expected present value of the early retirement benefit and the age 65 benefit calculated at the date of early retirement using an appropriate market discount rate rather than the internal rate of return. Thus, the actuarial computation includes the probability of surviving to age 65 while the regression result does not.

The results for the year of retirement dummy variables are mixed with all three coefficients small. Workers retiring in 1968 had rates of return 2.27 percent higher and those retiring in 1969 1.76 percent lower than 1967 retirees; the 1970 cohort was treated about the same as the 1967 cohort. While the later cohorts in the sample generally faced higher OASDI tax rates, the marginal benefit rates in the benefit formula were also increased. Thus, the interaction of these factors apparently results in very small retirement cohort effects, controlling for changes in the underlying distribution of worker characteristics. This result is sensitive to our assumption that the real benefit is fixed at retirement which is not historically accurate. Later, annual benefit recomputations will be added to our analysis and we expect this to indicate a more favorable treatment for the earlier retirement cohorts in the sample.

The continuous variables measuring the effects of employment and earnings are important factors in determining rates of return. The elasticity of the rate of return with respect to *lifetime accumulated taxable earnings* (ACERN) is estimated at .278. This result is consistent with the results in tables 5 and 6 and suggests that expected rates of return to the OAI portion of the system vary substantially over earning groups. For example, the regression results suggest that a white man retiring at age 65 in 1967 with neither self-employment earnings nor dependent's benefits but working continuously in covered employment and with mean accumulated earnings of $114,200 has an expected real rate of return of 11.1 percent. This compares with expected rates of return of 17.7 and 9.4 percent for similar individuals with accumulated earnings one standard deviation below and above the mean, respectively.

We also estimate that with earnings and other factors held constant, *age at entry into covered employment* (AGEENT) 1 year later increases the natural logarithm of the rate of return by more than 2 percent. This translates into an estimated elasticity of the rate of return with respect to age at entry equal to .91 percent at the mean of AGEENT. This result supports the notion that workers who enter the labor force later, (that is, those who stay in school longer) receive higher rates of return, holding other factors (including taxable earnings) constant. Two cases are illustrated in chart 2 where accumulated earnings are equal $(A + B = C + D + D')$, year and age at retirement are equal, and the *number of years with nonzero earnings* (SERLEN) are equal. 24/ Case 2 represents an individual with more schooling who enters the labor force later but soon

24/ The areas under the curves in the bottom graph equal ACERN for the two workers. For these areas to be equal, the accumulated value of the first year's earnings for the early entrant (A) plus the accumulated value of the difference between the early entrant's earnings and the later entrant's earnings while the early entrant's earnings were higher (B) must equal the sum of areas C, D, and D'. Area C represents the value of the later entrant's earnings while the early entrant leaves covered employment. Note that for SERLEN to be equal for both cases an area like C must exist.

receives a higher wage than individual 1. According to the regression results, individual 2 receives a higher rate of return than individual 1. This is only an illustration of how the necessary cases look (equal accumulated earnings, same year of retirement, same length of service but different age at entry) and may not be an appropriate description of actual behavior. For example, workers with higher education levels also tend to retire at later ages, and the results suggest that this factor decreases the expected rate of return.

Another result, which is simply explained, is that the rate of return increases with the *proportion of income from self-employment* (SE/TX). This is due to our assumption of 100 percent backward shifting of the employer's share of the social security tax; the effective tax rate on self-employment taxable income is then lower, by assumption, than that on wages and salaries.

Finally, the partial effect of an increase in the *number of years with nonzero earnings* (SERLEN) is small and positive. Several factors interact to make the expected sign of this coefficient uncertain. One factor is the method used to compute the benefit amount. For most individuals, only earnings after 1951 are eligible for averaging in computing the benefit base; the 5 lowest years of earnings after 1951 are excluded in the computation. If the ages of entry and retirement and total earnings after 1951 were held constant, then workers with fewer service years over the same period must have higher average taxable earnings per year of positive earnings than workers with more service years. Since the lowest 5 years of earnings after 1951 are excluded in the base computation, the workers with less service length in this case might be expected to have higher benefit bases and benefit levels. In the regressions, however, accumulated earnings after 1937 rather than total earnings after 1951 are held constant. Thus, the time period over which ACERN is calculated differs from the time period employed in the benefit base computation, and in computing ACERN for each worker earnings are weighted according to when they occurred. In addition, the tax rate on taxable earnings increased substantially over the period. The combination of these factors makes the expected sign of the SERLEN variable uncertain. For the individuals in the sample, the estimated coefficient is positive and quite small, although significantly different from zero. As the number of years included in the benefit base computation increases for future retirees, however, the size and/or sign of the coefficient may change. 25/

IV. Conclusions

Our results suggest that for individual retirees the old-age insurance portion of the social security program is progressive with respect to lifetime earnings. This is apparent from both the tabular summaries and

25/ Under present law, the base computation period for retirees is scheduled to increase each year until reaching a maximum of 35 years in 1991.

the regression results where the relation between the internal rate of return and the accumulated value of lifetime taxable real earnings (our crude measure of human wealth) is negative. This contradicts other results that the system has a net regressive character over individual life cycles.

A. Comparisons with Other Studies

Since other authors used earnings profiles derived from the representative individual approach this section begins with an appraisal of that method. Therefore, we have constructed three hypothetical case histories based on assumptions commonly employed in the representative individual approach, using our technique to calculate the internal rates of return associated with these particular earnings histories. Our hypothetical workers are men retiring at age 65 in 1970 with continuous covered employment after 1937. The rate of return for a worker with taxable earnings at the taxable maximum in each year is 8.46 percent, for a worker with earnings equal to the median earnings of all male workers in each year the rate of return is 9.15 percent, and for a worker with low earnings the rate of return is 10.95 percent. There is no consensus as to the proper representative low wage worker so we have adopted an approach similar to that used by the Social Security Administration, Office of the Actuary. 26/ In each year, the low wage income is in the same proportion to median earnings as is the earnings of a full-time worker earning the federal minimum wage in some base year (1972). These results may be compared with the rates of return for the 116 men retiring at age 65 in 1970 in our sample. The relevant information is summarized in table 13.

The hypothetical case histories are fairly representative in one sense but they are very misleading if they are intended to characterize the distribution of rates of return. The sense in which the hypothetical case histories are accurate is that the accumulated lifetime earnings calculated for the high, medium, and low wage workers are at the appropriate points (97th, 49th, and 18th percentile respectively) in the distribution of ACERN. However, since the majority of men retiring in 1970 did so before the age of 65, and since their ACERN's are lower than the age 65 retirees, the hypothetical case histories overstate the earnings experience of *all* men retiring in the given year. In addition, the closeness with which the medium wage history matches the median of the distribution of ACERN may be a fortuitous accident which will not hold up in the future as the effects of changes in the demographic composition of the labor force are felt. In other words, this result should not be interpreted as a validation of the representative individual approach when the concern is with tracing the median of the earnings distribution.

26/ See the Actuarial Note by Rettig and Nichols (1973), (see reference).

TABLE 13.--Rates of return for actual and hypothetical case histories of men retiring at age 65 in 1970

Workers		Number of cases	Average rate of return
	Accumulated lifetime earnings (quartile) 1/		
Actual 2/	Total................	116	10.14
	1..............................	29	15.06
	2..............................	29	9.29
	3..............................	29	8.38
	4..............................	29	7.84
Hypothetical	Accumulated lifetime earnings (percentile) 1/		
Low	113.21 (18)	---	10.95
Medium 3/	234.42 (49)	---	9.15
High	342.22 (97)	---	8.46

1/ Quartiles and percentiles are for the distribution of these 116 workers, not the full sample.
2/ See table A-11 for the results for the whole cohort.
3/ Median wage and salary earnings of all men in each year. Earnings above the taxable maximum are estimated. See *Social Security Bulletin*, Annual Statistical Supplement, 1973, table 39.

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The three hypothetical case histories do a very poor job of characterizing the distribution of rates of return. Since the goal of most studies using this approach is to analyze the redistributional character of the system, this is a serious failing. As with accumulated earnings, the rate of return for the medium worker is close to that of an actual worker with median ACERN but this rate of return, 9.15, is below the average rate of return (10.14). In addition, the rate of return for the hypothetical high-wage worker is somewhat high while that for the low-wage worker is much too low. Therefore, comparisons of these three representative case histories lead to the conclusion that the net operation of the system was substantially less progressive than it actually has been.

In fact, using statistically derived earnings profiles, Henry Aaron finds that the progressivity of the retirement benefit formula is fully offset by differential mortality rates. The resolution of the apparent conflict between our results and Aaron's may rest on two factors. First, Aaron used differentials in mortality rates which are less aggregative than ours. Because of the characteristics of data base, we are limited to differentials by age, race, and sex while Aaron has been able to consider the effects of education, income, marital status, and other factors. Although we cannot discuss the extent to which education and income specific mortality differentials would alter our results, we can compare the results by aggregate race and sex groups. For these groups, our estimates of the relative differences in rates of return appear to be somewhat smaller than Aaron's.

The second reason to expect Aaron's results to indicate less progression than ours is the treatment of unemployment and labor force participation in the calculation of representative earnings profiles. If low wage workers were more susceptible to cyclical unemployment or if they move out of covered employment more frequently than high wage workers, their actual average earnings will be smaller than that calculated from the representative earnings profile based on a single cross section. With lower average earnings they would receive a higher relative benefit (benefit amount divided by average earnings) and a higher rate of return.

Aaron also concludes that "variations in age at entry into the labor force associated with differences in educational attainment reinforce these effects (effects of differential mortality rates)." This is consistent with our result that later entry into covered employment tends to raise the rate of return. However, the relation between age of entry and educational attainment is not clear, since many highly educated workers are employed at least part time during their education. This relation is being investigated. Also, if more highly educated workers postpone retirement, our results indicate that their rates of return will be lower, *ceteris paribus*.

Thus far only relative rates of return have been compared. It is also informative to consider the absolute magnitudes of the rate of return derived by others for recent retirees. Chen and Chu find rates of return for 1974 retirees with annual earnings at the taxable maximum or with earnings equal to the average for all workers to be 6.1 and 7.3 percent respectively. The average rates of return for all workers in the sample is 14.8 percent while the average for high wage workers (in the fourth quartile of the ACERN distribution) is 8.4 percent. Therefore, it appears that Chen and Chu understate the true rate of return. Part of this is due to their failure to exclude the survivors insurance portion of the tax payment. Also, since taxes have risen rapidly since the late 1960's, rates of return for 1974 retirees may be lower than for persons retiring between 1967 and 1970. This may also contribute to the lower rates of return reported by Okonkwo. For single white men living outside the south and with 8, 12, or 16 or more years of schooling, Okonkwo found rates of return of 7.3, 7.1, and 6.7 percent respectively by assuming no real growth in retirement benefits.

B. Future Work

We feel that this paper demonstrates the comparative advantage of using actual case histories in analyzing the social security old-age insurance program. Unfortunately, the data base used is not rich enough to shed light on many of the questions of current interest. Also, the degree to which the use of analytically superior methods of deriving hypothetical case histories, such as those employed by Aaron, would attenuate our criticism of the representative individual approach can not be evaluated with the data available. However, richer data bases may enable us to both test the more sophisticated representative individual approach and provide estimates of the rates of return earned by workers disaggregated by a more complete set of individual characteristics.

A data base derived from the Current Population Survey and internal social security program data is now available. 27/ This file may permit us to replicate the results of Aaron and Okonkwo for disaggregated economic and demographic characteristics using fairly complete earnings histories. In particular, information on the education and marital status of retirees should permit the application of mortality rates differentiated by these characteristics. We also hope to take advantage of new research seeking to adjust existing mortality rates for census undercount and age misreporting.

A significant advantage of the new data base should be that the earnings records of members of the same family may be linked together. Therefore, the treatment of single and married workers as well as the treatment of

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27/ For a brief description of these files see F. J. Scheuren and B. Tyler, "Matched Current Population Survey and Social Security Data Bases," *Public Data Use*, vol. 3, July 1975.

families with working or nonworking wives may be compared. These data may also serve as the basis for expanding our analysis to include the current insurance value of survivors and disability coverage. In addition, since this data base contains total rather than covered earnings data (for a single year only) we may be able to analyze the effect of the social security system on the distribution of total earnings. One example of the importance of this is to measure the significance of such unintended net transfers as the high rates of return earned by workers in uncovered employment who become entitled to benefits through secondary or postretirement employment.

Finally, the analysis must be extended to future retirees. We acknowledge that our estimate of the absolute level of the rate of return is not applicable in the future. This rests on several factors: (1) future economic and demographic patterns will affect the ability and willingness of the working population to provide transfers to the retired and (2) since nearly all workers are now covered, there are no further opportunities for additional tax revenues resulting from increases in coverage. Also, current workers are paying significantly higher taxes than current retirees did so their rates of return may be lower, *ceteris paribus*.

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APPENDIX A

Detailed Tabular Results

TABLE A-1.--Average internal rates of return, full sample

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	1/ 2,612	14.80	12.44	$1,074	$436
1	1/ 653	25.22	21.07	602	159
2	653	14.40	3.03	910	274
3	653	11.19	1.85	1,228	313
4	653	8.41	.90	1,557	236
Age 62-64					
Total	1,764	14.15	8.25	933	361
1	478	21.74	12.13	558	117
2	516	13.83	2.67	832	203
3	431	10.85	1.73	1,102	262
4	339	8.10	.82	1,403	193
Age 65					
Total	698	13.19	8.01	1,453	379
1	85	27.34	14.57	777	205
2	115	16.64	3.30	1,199	304
3	196	11.90	1.89	1,481	244
4	302	8.73	.85	1,721	148
Age 66 and over					
Total	1/ 150	30.06	36.83	971	450
1	1/ 90	41.73	43.79	671	166
2	22	15.98	3.58	1,230	332
3	26	11.33	1.99	1,418	313
4	12	8.89	1.27	1,779	164

1/ Excludes 30 special age-72 beneficiaries.

TABLE A-2.--Average internal rates of return, men

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	1/1,225	11.67	5.87	$1,244	$428
1	1/161	21.93	9.21	589	150
2	210	14.22	3.18	905	253
3	297	10.74	1.76	1,249	307
4	557	8.24	.81	1,559	232
Age 62-64					
Total	758	11.82	6.04	1,089	371
1	113	21.16	9.56	552	119
2	163	13.81	2.96	841	191
3	194	10.46	1.84	1,135	268
4	288	7.94	.73	1,408	193
Age 65					
Total	415	10.74	4.47	1,551	341
1	24	23.09	7.86	686	164
2	41	15.95	3.47	1,147	316
3	90	11.34	1.50	1,479	249
4	260	8.56	.75	1,720	144
Age 66 and over					
Total	1/52	17.00	9.19	1,066	491
1	1/24	24.41	8.54	661	195
2	6	13.79	3.35	987	291
3	13	10.73	1.09	1,358	305
4	9	8.41	.98	1,775	187

1/ Excludes four special age-72 beneficiaries.

TABLE A-3.--Average intern[illegible]s of return, women

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	1/1,387	17.57	15.65	$924	$386
1	1/492	26.30	23.60	606	162
2	443	14.48	2.95	912	284
3	356	11.56	1.85	1,211	317
4	96	9.39	76	1,540	254
Age 62-64					
Total	1,006	15.90	9.20	816	305
1	365	21.91	12.83	559	117
2	353	13.85	2.52	827	209
3	237	11.17	1.57	1,075	254
4	51	9.03	.66	1,375	195
Age 65					
Total	283	16.79	10.36	1,375	195
1	61	29.01	16.23	813	209
2	74	17.02	3.17	1,228	295
3	106	12.38	2.06	1,483	241
4	42	9.77	.62	1,724	173
Age 66 and over					
Total	1/98	36.98	43.59	920	420
1	1/66	48.03	49.48	674	156
2	16	16.80	3.40	1,320	306
3	13	11.92	2.51	1,478	322
4	3	10.32	.92	1,793	90

1/ Excludes 26 special age-72 beneficiaries.

TABLE A-4.—Average internal rates of return, white men

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/1,094	11.46	5.76	$1,273	$416
1........................	1/124	22.32	9.58	602	158
2........................	173	14.57	3.31	922	259
3........................	273	10.79	1.80	1,250	309
4........................	524	8.22	.80	1,559	234
Age 62-64					
Total................	670	11.53	5.85	1,118	360
1........................	83	21.39	9.98	565	129
2........................	135	14.11	3.09	855	197
3........................	181	10.51	1.87	1,138	269
4........................	271	7.92	.73	1,406	193
Age 65					
Total................	387	10.66	4.46	1,563	334
1........................	21	23.24	8.10	678	159
2........................	36	16.18	3.56	1,160	309
3........................	82	11.41	1.54	1,491	248
4........................	248	8.54	.75	1,721	145
Age 66 and over					
Total................	1/37	18.63	9.98	1,034	493
1........................	1/20	25.21	9.06	678	210
2........................	2	16.84	5.16	1.163	541
3........................	10	10.86	1.20	1,314	314
4........................	5	8.58	1.22	1,850	102

1/ Excludes three special age-72 beneficiaries.

TABLE A-5.--Average internal rates of return, men other than white

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/131	13.39	6.42	$1,006	$448
1......................	1/ 37	20.62	7.84	543	110
2......................	37	12.59	1.77	827	209
3......................	24	10.17	.95	1,234	300
4......................	33	8.51	.82	1,561	216
Age 62-64					
Total................	88	13.96	7.02	862	375
1......................	30	20.51	8.43	518	80
2......................	28	12.33	1.64	775	145
3......................	13	9.87	1.08	1,094	275
4......................	17	8.24	.70	1,432	195
Age 65					
Total................	28	11.81	4.66	1,387	397
1......................	3	22.03	7.18	741	220
2......................	5	14.31	2.33	1,058	387
3......................	8	10.62	.68	1,357	245
4......................	12	8.99	.83	1,704	104
Age 66 and over					
Total................	1/ 15	12.96	5.20	1,144	494
1......................	1/ 4	20.41	3.65	581	61
2......................	4	12.26	.68	899	112
3......................	3	10.30	.53	1,506	267
4......................	4	8.21	.70	1,680	241

1/ Excludes one special age-72 beneficiary.

TABLE A-6.--Average internal rates of return, white women

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/1,249	17.03	14.40	$937	$389
1.........................	1/41	25.79	22.29	607	169
2.........................	405	14.47	2.95	908	288
3.........................	338	11.56	1.86	1,206	317
4.........................	94	9.38	.76	1,538	256
Age 62-64					
Total................	913	15.44	8.37	825	307
1.........................	311	21.30	11.86	561	122
2.........................	326	13.79	2.44	822	208
3.........................	226	11.18	1.59	1,072	257
4.........................	50	9.02	.66	1,369	193
Age 65					
Total................	261	16.59	10.27	1,335	377
1.........................	50	29.96	16.68	838	221
2.........................	69	17.11	3.20	1,241	297
3.........................	101	12.39	2.08	1,486	241
4.........................	41	9.75	.62	1,724	175
Age 66 and over					
Total................	1/75	34.93	42.30	917	424
1.........................	1/51	49.05	47.38	664	160
2.........................	10	18.27	3.54	1,411	295
3.........................	11	11.81	2.57	1,398	262
4.........................	3	10.32	.92	1,793	90

1/ Excludes 21 special age-72 beneficiaries.

TABLE A-7.--Average internal rates of return, women other than white

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/138	22.45	23.72	$803	$333
1........................	1/80	28.92	29.47	599	123
2........................	38	14.67	2.99	952	238
3........................	18	11.54	1.57	1,301	320
4........................	2	9.85	.73	1,671	46
Age 62-64					
Total................	93	20.40	14.43	728	273
1........................	54	25.44	17.09	548	87
2........................	27	14.54	3.35	888	206
3........................	11	11.07	1.21	1,135	165
4........................	1	9.33	0	1,638	0
Age 65					
Total................	22	19.19	11.31	988	367
1........................	11	24.72	13.87	708	90
2........................	5	15.77	2.71	1,038	201
3........................	5	12.18	1.75	1,420	239
4........................	1	10.37	0	1,704	0
Age 66 and over					
Total................	1/ 23	33.89	48.43	932	417
1........................	1/ 15	44.55	57.74	706	142
2........................	6	14.35	.82	1,170	285
3........................	2	12.50	2.95	1,917	326
4........................	0	0	0	0	0

1/ Excludes five special age-72 beneficiaries.

TABLE A-8.--Average internal rates of return, men, 1967 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/294	13.18	8.17	$1,124	$402
1........................	1/58	24.40	11.92	537	142
2........................	43	15.56	3.41	995	293
3........................	71	10.66	1.69	1,157	296
4........................	122	8.48	.65	1,429	188
Age 62-64					
Total................	182	13.27	8.64	980	341
1........................	40	23.99	12.74	512	128
2........................	30	14.78	2.97	880	215
3........................	47	10.23	1.63	1,013	228
4........................	65	8.19	.54	1,290	146
Age 65					
Total................	97	11.97	5.88	1,440	308
1........................	9	24.61	9.30	661	206
2........................	12	17.76	3.67	1,288	277
3........................	20	11.68	1.58	1,463	192
4........................	56	8.79	.62	1,590	62
Age 66 and over					
Total................	1/15	19.93	11.66	829	406
1........................	1/ 9	26.04	11.48	528	0
2........................	1	12.67	0	950	0
3........................	4	10.68	.91	1,318	198
4........................	1	9.24	0	1,467	0

1/ Excludes three special age-72 beneficiaries.

TABLE A-9.--Average internal rates of return, men, 1968 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	283	12.14	5.29	$1,252	$406
1........................	30	21.14	9.05	607	169
2........................	68	14.92	3.12	930	255
3........................	70	11.51	2.12	1,331	266
4........................	115	8.54	.83	1,562	218
Age 62-64					
Total................	176	12.52	5.85	1,085	351
1........................	23	20.90	10.12	558	101
2........................	54	14.56	2.95	872	210
3........................	39	11.47	2.36	1,210	238
4........................	60	8.14	.70	1,397	165
Age 65					
Total................	93	10.86	3.33	1,597	264
1........................	2	20.82	4.99	789	196
2........................	10	16.95	3.26	1,198	280
3........................	27	11.62	1.85	1,518	198
4........................	54	8.97	.76	1,741	91
Age 66 and over					
Total................	14	15.97	6.17	1,051	384
1........................	5	22.34	4.66	762	287
2........................	4	14.70	3.88	1,048	348
3........................	4	11.07	1.44	1,243	242
4........................	1	8.82	0	1,746	0

TABLE A-10.—Average internal rates of return, men, 1969 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/323	10.95	4.80	$1,242	$403
1........................	1/41	20.04	6.24	599	136
2........................	45	13.71	3.11	871	228
3........................	82	10.52	1.65	1,246	307
4........................	155	7.96	.78	1,517	208
Age 62-64					
Total................	198	10.99	4.46	1,102	352
1........................	28	18.87	4.22	568	129
2........................	35	13.47	3.28	817	170
3........................	52	10.27	1.85	1,153	283
4........................	83	7.73	.70	1,370	154
Age 65					
Total................	109	10.17	4.04	1,510	332
1........................	6	21.11	9.64	621	68
2........................	9	14.90	2.14	1,094	306
3........................	26	11.00	1.13	1,404	259
4........................	68	8.26	.79	1,685	108
Age 66 and over					
Total................	1/16	15.70	9.37	1,143	514
1........................	1/ 7	23.82	8.84	705	167
2........................	1	11.26	0	781	0
3........................	4	10.65	1.20	1,425	454
4........................	4	7.64	.49	1,719	148

1/ Excludes one special age-72 beneficiary.

TABLE A-11.--Average internal rates of return, men, 1970 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	325	10.61	4.30	$1,350	$464
1	32	20.61	5.61	650	136
2	54	12.71	2.39	830	214
3	74	10.33	1.31	1,264	335
4	165	8.11	.80	1,694	225
Age 62-64					
Total	202	10.70	4.11	1,177	407
1	22	19.18	5.47	601	86
2	44	12.48	2.15	797	157
3	56	10.13	1.30	1,170	278
4	80	7.79	.82	1,550	197
Age 65					
Total	116	10.14	4.14	1,646	396
1	7	23.49	5.52	743	152
2	10	13.73	3.19	976	351
3	17	11.01	1.19	1,549	341
4	82	8.39	.64	1,825	155
Age 66 and over					
Total	7	15.72	8.29	1,425	613
1	3	24.34	3.10	793	229
2	0	0	0	0	0
3	1	9.94	0	1,713	0
4	3	9.04	1.15	1,961	33

TABLE A-12.--Average internal rates of return, women, 1967 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/344	19.25	13.97	$846	$370
1.........................	1/150	26.72	18.29	584	189
2.........................	106	15.29	3.40	907	298
3.........................	67	11.69	1.61	1,131	305
4.........................	21	9.94	.67	1,497	246
Age 62-64					
Total................	237	17.49	10.19	719	263
1.........................	109	22.82	12.83	531	142
2.........................	77	14.33	2.74	790	174
3.........................	44	11.06	.99	980	240
4.........................	7	9.59	.71	1,219	246
Age 65					
Total................	81	18.59	12.44	1,222	379
1.........................	20	31.55	19.09	776	208
2.........................	26	17.68	3.66	1,185	336
3.........................	22	12.94	1.91	1,428	185
4.........................	13	10.05	.55	1,631	54
Age 66 and over					
Total................	1/26	37.37	28.80	832	394
1.........................	1/21	42.40	29.88	677	231
2.........................	3	19.40	4.34	1,502	182
3.........................	1	12.01	0	1,215	0
4.........................	1	11.08	0	1,705	0

1/ Excludes 10 special age-72 beneficiaries.

TABLE A-13.--Average internal rates of return, women, 1968 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
<u>All ages</u>					
Total.................	1/326	18.51	19.65	$938	$381
1........................	1/111	28.93	30.95	622	146
2........................	114	14.57	2.65	917	262
3........................	77	12.13	2.31	1,227	340
4........................	24	9.52	.90	1,569	214
<u>Age 62-64</u>					
Total.................	250	16.13	9.11	851	307
1........................	85	22.45	12.98	586	117
2........................	96	14.30	2.70	871	241
3........................	54	11.37	1.56	1,072	226
4........................	15	9.07	.74	1,439	149
<u>Age 65</u>					
Total.................	52	18.94	12.39	1,347	415
1........................	13	33.60	17.77	832	194
2........................	13	16.19	1.48	1,228	236
3........................	19	13.96	2.75	1,624	265
4........................	7	10.37	.55	1,772	91
<u>Age 66 and over</u>					
Total.................	1/24	42.45	59.63	947	425
1........................	1/13	66.61	73.67	646	47
2........................	5	15.68	2.74	988	153
3........................	4	13.66	3.52	1,426	344
4........................	2	9.94	.91	1,837	68

1/ Excludes nine special age-72 beneficiaries.

TABLE A-14.--Average internal rates of return, women, 1969 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/347	16.97	16.72	$904	$961
1........................	1/116	26.31	26.34	586	131
2........................	106	14.05	2.71	861	269
3........................	96	11.29	1.61	1,167	262
4........................	29	9.09	.57	1,459	240
Age 62-64					
Total................	262	15.38	9.93	820	307
1........................	90	21.65	14.74	559	111
2........................	87	13.46	2.25	787	210
3........................	67	11.22	1.71	1,072	232
4........................	18	8.86	.51	1,351	191
Age 65					
Total................	64	15.63	10.13	1,260	337
1........................	11	29.40	18.19	765	207
2........................	17	16.71	3.15	1,187	260
3........................	25	11.54	1.45	1,362	158
4........................	11	9.47	.46	1,635	209
Age 66 and over					
Total................	1/21	40.87	50.88	861	412
1........................	1/15	52.02	56.81	619	38
2........................	2	17.13	2.97	1,311	48
3........................	4	10.94	.44	1,543	277
4........................	0	0	0	0	0

1/ Excludes five special age-72 beneficiaries.

TABLE A-15.--Average internal rates of return, women, 1970 cohort

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/370	15.74	11.38	$1,003	$411
1........................	1/115	23.18	17.91	604	163
2........................	117	14.05	2.88	958	301
3........................	116	11.33	1.74	1,284	336
4........................	22	9.11	.56	1,657	287
Age 62-64					
Total................	257	14.74	7.18	867	316
1........................	81	20.43	10.21	570	70
2........................	93	13.34	2.26	851	187
3........................	72	11.05	1.74	1,138	286
4........................	11	8.88	.60	1,423	183
Age 65					
Total................	86	14.65	5.52	1,400	394
1........................	17	22.26	6.11	875	225
2........................	18	16.96	3.34	1,327	301
3........................	40	11.84	1.59	1,522	259
4........................	11	9.35	.41	1,891	136
Age 66 and over					
Total................	1/ 27	28.73	32.29	1,028	442
1........................	1/ 17	37.24	38.43	740	144
2........................	6	16.32	3.71	1,510	274
3........................	4	11.13	2.54	1,531	428
4........................	0	0	0	0	0

1/ Excludes two special age-72 beneficiaries.

TABLE A-16.--Average internal rates of return, men, 1967 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All Ages					
Total.................	1/294	13.18	8.17	$1,124	$402
1..........................	1/73	22.61	11.29	599	209
2..........................	74	12.87	3.21	1,111	287
3..........................	73	9.14	.80	1,311	250
4..........................	74	8.18	.48	1,469	171
Age 62-64					
Total.................	182	13.27	8.64	980	341
1..........................	51	21.98	11.96	561	168
2..........................	50	12.36	3.01	989	224
3..........................	44	8.75	.56	1,162	198
4..........................	37	7.88	.37	1,327	129
Age 65					
Total.................	97	11.97	5.88	1,440	308
1..........................	13	22.73	8.42	802	297
2..........................	20	14.44	3.51	1,408	228
3..........................	27	9.75	.77	1,537	115
4..........................	37	8.47	.38	1,611	38
Age 66 and over					
Total.................	1/15	19.93	11.66	829	406
1..........................	1/9	26.04	11.48	528	0
2..........................	4	11.34	1.20	1,152	135
3..........................	2	9.63	.55	1,540	104
4..........................	0	0	0	0	0

1/ Excludes three special age-72 beneficiaries.

TABLE A-17.--Average internal rates of return, men, 1968 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	283	12.14	5.29	$1,252	$406
1	71	17.91	6.88	748	224
2	71	12.97	2.56	1,207	312
3	71	9.51	.85	1,457	238
4	70	8.12	.56	1,601	190
Age 62-64					
Total	176	12.52	5.85	1,085	351
1	56	17.60	7.37	697	172
2	47	12.84	2.41	1,110	279
3	37	9.04	.79	1,282	163
4	36	7.78	.41	1,453	141
Age 65					
Total	93	10.86	3.33	1,597	264
1	7	18.39	3.65	1,011	216
2	19	13.68	2.99	1,447	289
3	34	10.03	.61	1,647	142
4	33	8.48	.46	1,757	77
Age 66 and over					
Total	14	15.97	6.17	1,051	384
1	8	19.73	5.58	871	349
2	5	11.39	1.45	1,200	231
3	0	0	0	0	0
4	1	8.82	0	1,746	0

TABLE A-18.--Average internal rates of return, men, 1969 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total.................	1/323	10.95	4.80	$1,242	$403
1........................	1/81	17.03	5.79	730	220
2........................	81	10.72	1.72	1,226	320
3........................	81	8.48	.77	1,447	228
4........................	80	7.51	.47	1,568	188
Age 62-64					
Total.................	198	10.99	4.46	1,102	352
1........................	59	16.23	4.51	702	202
2........................	52	10.44	1.76	1,127	296
3........................	45	8.21	.63	1,303	182
4........................	42	7.28	.41	1,416	129
Age 65					
Total.................	109	10.17	4.04	1,510	332
1........................	14	17.42	7.01	856	289
2........................	25	11.32	1.60	1,400	264
3........................	35	8.84	.81	1,631	132
4........................	35	7.78	.39	1,730	44
Age 66 and over					
Total.................	1/16	15.70	9.37	1,143	514
1........................	1/ 8	22.25	9.31	715	157
2........................	4	10.65	1.20	1,425	454
3........................	1	8.00	0	1,500	0
4........................	3	7.52	.52	1,792	25

1/ Excludes one special age-72 beneficiary.

TABLE A-19.--Average internal rates of return, men, 1970 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total	325	10.61	4.30	$1,350	$464
1	82	15.83	5.52	747	190
2	81	10.40	1.33	1,274	342
3	81	8.59	.61	1,663	222
4	81	7.55	.49	1,723	226
Age 62-64					
Total	202	10.70	4.11	1,177	407
1	63	14.87	4.83	720	157
2	60	10.19	1.30	1,166	278
3	36	8.37	.64	1,522	192
4	43	7.25	.43	1,575	203
Age 65					
Total	116	10.14	4.14	1,646	396
1	16	18.00	6.58	843	269
2	20	11.04	1.29	1,577	330
3	43	8.72	.50	1,768	176
4	37	7.90	.30	1,889	96
Age 66 and over					
Total	7	15.72	8.29	1,425	613
1	3	24.34	3.10	793	229
2	1	9.94	0	1,713	0
3	2	9.69	.20	1,955	44
4	1	7.72	0	1,974	0

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TABLE A-20.--Average internal rates of return, women, 1967 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/344	19.25	13.97	$846	$370
1........................	1/ 86	32.59	22.04	527	150
2........................	86	18.70	4.76	718	240
3........................	86	14.54	2.84	923	317
4........................	86	11.17	1.43	1,214	331
Age 62-64					
Total................	237	17.49	10.19	719	263
1........................	59	26.98	15.88	473	84
2........................	66	17.81	4.06	649	191
3........................	61	13.50	1.84	786	172
4........................	51	10.86	1.08	1,013	252
Age 65					
Total................	81	18.59	12.44	1,222	379
1........................	8	45.26	23.62	676	172
2........................	17	21.62	6.16	903	231
3........................	23	17.07	3.43	1,233	346
4........................	33	11.62	1.79	1,510	174
Age 66 and over					
Total................	1/26	37.37	28.80	832	394
1........................	1/19	44.68	30.56	636	201
2........................	3	21.91	2.87	1,194	221
3........................	2	16.93	1.00	1,529	249
4........................	2	11.55	.65	1,460	347

1/ Excludes 10 special age-72 beneficiaries.

TABLE A-21.--Average internal rates of return, women, 1968 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/326	18.51	19.65	$938	$381
1........................	1/ 82	33.03	35.06	586	101
2........................	81	16.08	3.55	786	192
3........................	82	13.84	2.45	1,040	344
4........................	81	10.98	1.74	1,341	309
Age 62-64					
Total................	250	16.13	9.11	851	307
1........................	60	25.03	14.62	550	73
2........................	68	15.57	2.99	740	166
3........................	67	13.30	2.25	944	269
4........................	55	10.55	1.40	1,206	228
Age 65					
Total................	52	18.94	12.39	1,347	415
1........................	9	37.89	19.83	738	142
2........................	10	19.53	5.26	1,050	103
3........................	12	16.27	1.69	1,512	282
4........................	21	12.08	2.13	1,656	235
Age 66 and over					
Total................	1/24	42.45	59.63	947	425
1........................	1/13	66.61	73.67	646	47
2........................	3	16.16	3.63	967	195
3........................	3	16.21	2.36	1,293	480
4........................	5	11.17	1.54	1,507	351

1/ Excludes nine special age-72 beneficiaries.

TABLE A-22.--Average internal rates of return, women 1969 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total................	1/347	16.97	16.72	$904	$361
1........................	1/ 87	29.41	29.70	552	84
2........................	87	15.47	3.59	761	210
3........................	87	12.88	2.23	1,022	303
4........................	86	10.05	1.12	1,284	280
Age 62-64					
Total................	262	15.38	9.93	820	307
1........................	64	23.73	16.85	520	57
2........................	75	14.95	3.29	713	163
3........................	70	12.43	1.95	945	275
4........................	53	9.82	1.14	1,168	245
Age 65					
Total................	64	15.63	10.13	1,260	337
1........................	8	32.46	20.66	682	125
2........................	11	18.64	4.03	1,040	233
3........................	16	14.70	2.52	1,338	196
4........................	29	10.35	1.01	1,460	228
Age 66 and over					
Total................	1/21	40.87	50.88	861	412
1........................	1/15	52.02	56.81	619	38
2........................	1	19.23	0	1,277	0
3........................	1	15.03	0	1,344	0
4........................	4	10.94	.44	1,543	277

1/ Excludes five special age-72 beneficiaries.

TABLE A-23.--Average internal rates of return, women, 1970 cohort (sex-cohort specific earnings quartiles)

Age at retirement and accumulated lifetime earnings quartile	Number of cases	Rate of return		Benefit amount	
		Mean	Standard deviation	Mean	Standard deviation
All ages					
Total.................	1/370	15.74	11.38	$1,003	$411
1........................	1/ 93	24.84	19.44	611	127
2........................	92	15.07	3.62	854	252
3........................	93	12.79	1.94	1,167	372
4........................	92	10.20	1.16	1,382	334
Age 62-64					
Total.................	257	14.74	7.18	867	316
1........................	66	21.85	10.80	556	47
2........................	72	14.03	2.37	769	182
3........................	68	12.21	1.54	1,019	275
4........................	51	9.93	1.08	1,207	263
Age 65					
Total.................	86	14.65	5.52	1,400	394
1........................	13	21.69	6.33	790	166
2........................	14	19.81	5.01	1,178	188
3........................	21	14.22	2.10	1,527	295
4........................	38	10.58	1.17	1,621	282
Age 66 and over					
Total.................	1/27	28.73	32.29	1,028	442
1........................	1/14	41.83	41.10	708	138
2........................	6	16.50	3.50	1,119	327
3........................	4	15.26	1.60	1,787	261
4........................	3	9.98	1.33	1,326	150

1/ Excludes two special age-72 beneficiaries.

CHART 1.-- Plot of ln(ROFR) AGAINST ln(ACERN)

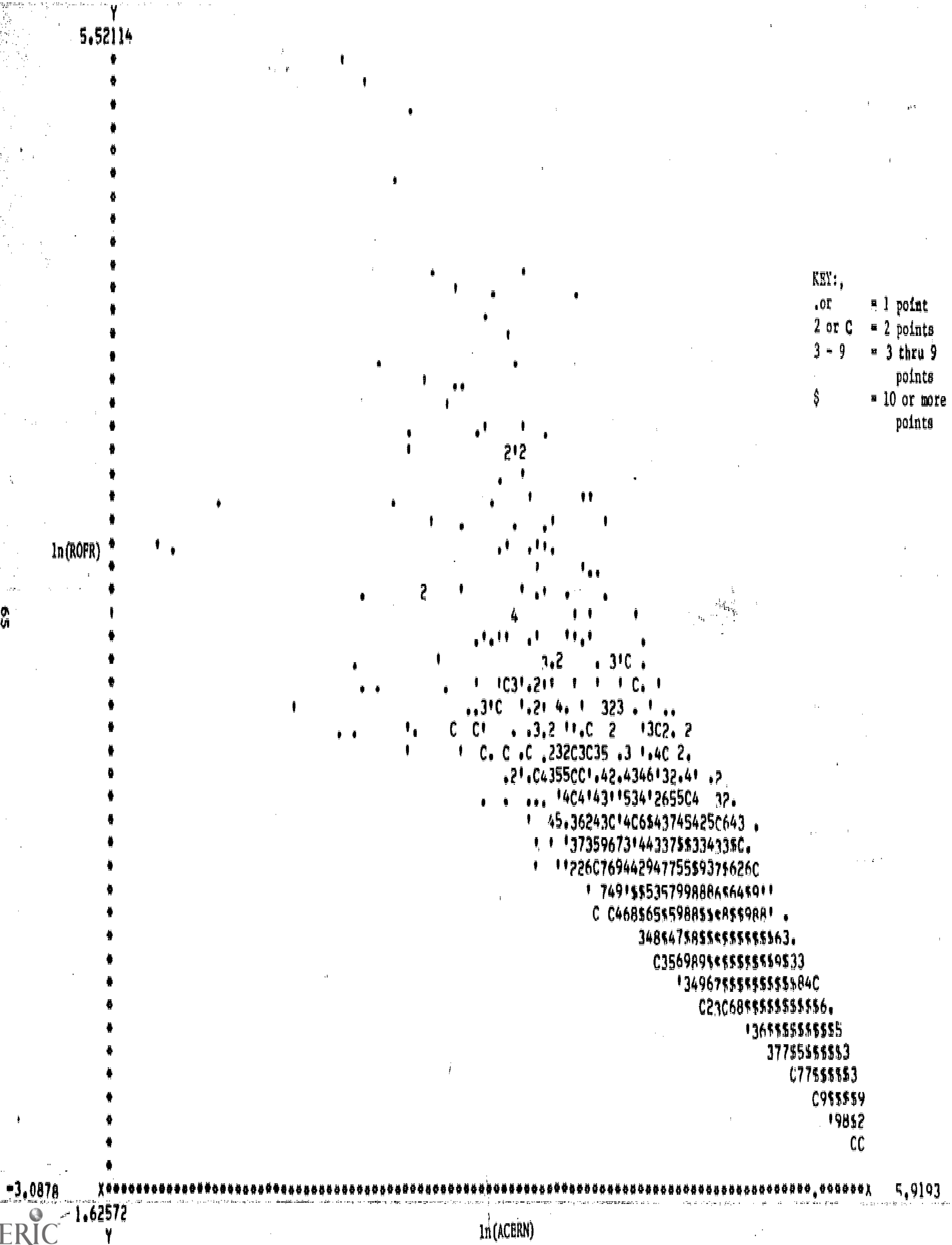
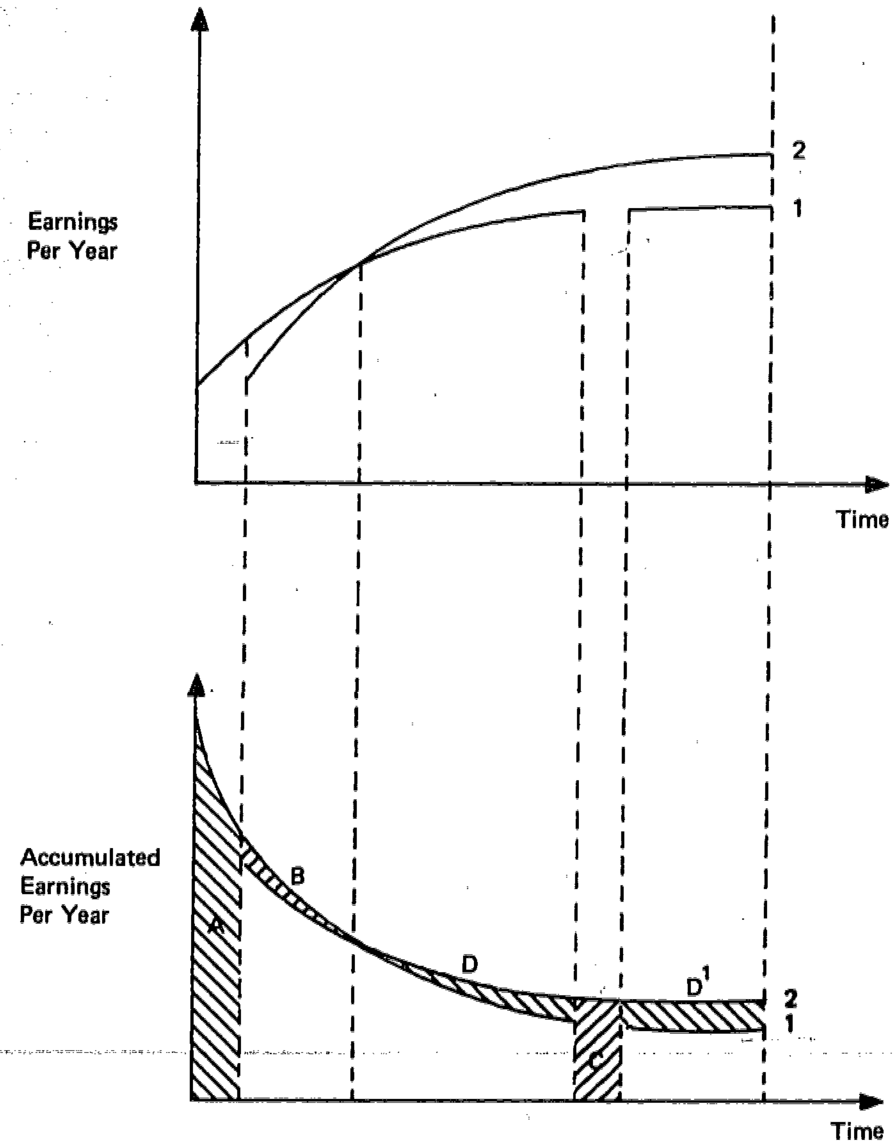


Chart 2.--Effect of age at entry



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