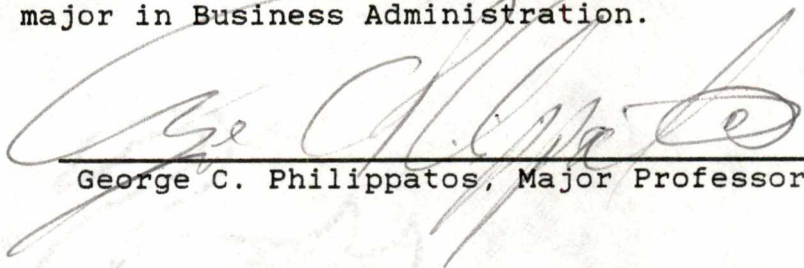


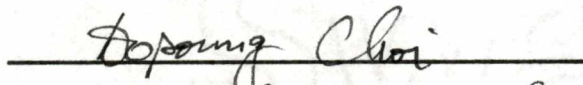
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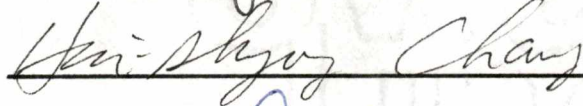
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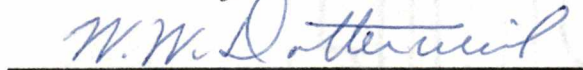


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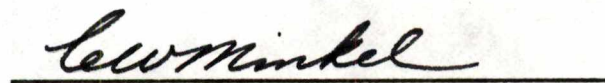
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A COMPARISON OF INVESTMENT IN SOCIAL SECURITY TO
INVESTMENT IN MARKET BENCHMARK ALTERNATIVES

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Dennis Wade Coffey

June 1988

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ABSTRACT

Many have suggested from time to time that had social security retirees been allowed to invest the same amounts contributed to the social security program in alternative investments, then some retirement annuities might have been larger. This suggestion implies that market valuations of contributions are needed to adequately resolve the issue. In this research valuations of hypothetical levels of contributions were derived using yields from market benchmark alternatives as the valuation rates. In particular, benchmark surrogates for the risk-free asset and market portfolio of risky assets were used.

The results of the research demonstrate that returns from investment in social security are superior to returns from investment in the risk-free surrogates for all hypothetical retirees. Also, returns from investment in social security are generally superior to returns from investment in the surrogates for the market portfolio of risky assets. This last result was particularly surprising in view of the assumed risk-free nature of social security benefits.

A major policy implication of the results of this research is that a market-based norm would be more desirable for assessing the achievement of individual equity in the social security benefit structure than what

is currently used. Similarly, an external norm is also needed for assessing the achievement of social adequacy.

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CHAPTER I

INTRODUCTION

Each individual who works in employment covered by the social security program (referred to hereafter as a covered worker) follows an earnings path that leads to an expected benefit stream. Associated with each earnings path is a contribution stream.¹ An empirical issue pertains to the valuation of this contribution stream vis-a-vis that of its associated expected benefit stream. Specifically, it has been proposed from time to time that had many retired covered workers been allowed to invest the same amounts contributed to the social security program in alternative investment strategies, then larger retirement annuities would have been possible.² This research examines this proposition.

A key assumption made in this examination is that at the time social security first collected taxes in 1937, each worker paying those taxes was given the opportunity to select an investment alternative from a set of funds. Assumed to have been included in this set are several

¹Contributions are taxes paid by employees, employers, and self-employed individuals to support the different social security programs. In social security literature "contributions" and "taxes" are used interchangeably.

²For example, see William C. Mitchell, The Popularity of Social Security: A Paradox in Public Choice (Washington, D. C., 1977), p. 5.

market funds as well as the social security program.

Subsequent to the worker's selection, all social security taxes paid by the worker are assumed to have been placed in the chosen alternative. These assumed placements permit multiple market valuations of contribution streams. The comparison of these valuations to those of associated social security benefit streams permits an examination of the alternative market investments proposition.

The valuation procedures employed in this research are a major feature that distinguishes it from other studies on the subject. First, the risk-free nature of social security benefits is explicitly recognized in the valuation of expected benefit streams. Risk-free, in the context of social security, is assumed to mean that once a person retires, the person's expected monthly benefits are fixed in real terms and will be paid for the entirety of the person's expected benefit horizon.³ While this meaning of risk-free is operational throughout this research, one should be aware that the "fixed" component of the definition is not totally accurate as applied to social security benefit streams. In reality, there is variation in realized levels of real benefits for all beneficiaries

³The "fixed" component of this definition is supported by many writers. In particular see Lawrence H. Thompson, "Indexing Social Security: The Options," Financing Social Security, ed. Colin D. Campbell (Washington, D. C., 1979), p. 67.

because of lags between inflation experiences and adjustments of nominal benefit streams to reflect these experiences. However, this research proceeds under the assumption that real benefits for retirees are frozen at initial entitlement levels.⁴ Since expected benefit streams are essentially risk-free, then their valuations should reflect this characteristic. In particular, discount rates used to value expected benefit streams should be expected risk-free rates. Second, as previously stated, valuations of social security contribution streams are derived assuming contributions had been invested in various market funds. Finally, the most important measurements obtained are ratios formed by dividing valuated expected benefit streams by associated valuated contribution streams and differences obtained by subtracting valuated contribution streams from associated valuated expected benefit streams.

The comparison of valuated expected benefit streams to valuations of associated contribution streams implies in many situations the comparison of the performance of a

⁴For an excellent discussion of the indexing of social security benefits to inflation experiences see Lawrence H. Summers, "Observations on the Indexation of Old Age Pensions," Financial Aspects of the United States Pension System, eds. Zvi Bodie and John B. Shoven (Chicago, 1983), pp. 231-251. Among Summers' many observations is that in the absence of a formal plan of indexing there is a tendency for positive real growth in a pension plan, and in the presence of a formal plan there is a tendency for real benefit levels to be constant.

risk-free fund,⁵ that is, social security, to the performance of risky market funds. Henry Aaron argues against such comparisons.⁶ He contends comparison of expected benefit streams valuated using expected risk-free rates to contributions valuated using risky market rates is unfair. Implicit in Aaron's argument is the belief that investment in the social security program has been inferior to investment in risky market alternatives. Indeed, one should expect such results if one believes that individuals who accept more risk are normally compensated by increases in expected return. Since social security benefit streams are essentially risk-free, once entitlement is realized, then their valuations should be similar to the valuations of the associated contributions when derived using actual risk-free rates. That is, if a person expects a risk-free stream of payments at retirement, then this person knows the monthly payments should be an annuity with a present value equal to the associated contribution stream

⁵A risk-free fund is, as the phrase implies, free of all risk. The expected rates of return from investing in such funds will equal the realized rates of return from investing in such funds. If the capital markets are in equilibrium and considering a specific one period framework, then all risk-free assets will have the same expected and realized returns. For a discussion of the risk-free fund see Diana R. Harrington, Modern Portfolio Theory and the Capital Asset Pricing Model (Englewood Cliffs, N. J., 1983), pp. 13, 29-34, 99-108, 121-125.

⁶Henry J. Aaron, Economic Effects of Social Security (Washington, D. C, 1982), pp. 73-81.

compounded at risk-free rates to the date of retirement. If the contribution stream is compounded using risky rates, and if the associated valuated expected benefit stream is of equivalent value, then a payment abnormality would be indicated.

In addition to allowing for the examination of performance abnormalities, the comparison of valuated benefit streams to associated valuated contribution streams permits the re-examination of many controversies pertaining to the distribution of social security wealth. One such controversy is that the structure of the social security benefit plan causes an imbalance in social security wealth distribution, whether by design, happenstance, or both.⁷ This controversy has been a divisive issue since the inception of the social security program when program executives and Congressional legislators were in conflict over the proper operating principle(s) of the program. Congressional legislators favored the pursuance of individual equity, a concept which refers to a direct, positive relationship between the level of contributions to social security and level of benefits from social security.⁸ At the same time, program executives favored

⁷Martha Derthick, Policymaking for Social Security (Washington, D. C., 1979), pp. 213-227.

⁸Mitchell, p. 5.

the pursuance of social adequacy, a philosophical concept which refers to the establishment of a minimal subsistence level of income for social security retirees.⁹ The program in place today has been flavored by both principles with much ambiguity as to which, if either, has dominated the program's operation.¹⁰ The feature of the social security benefit structure influenced by the individual equity concept is the direct linkage between expected benefit amounts and historical average earnings. The feature of the benefit structure influenced by the social adequacy concept is the weighting of the benefit structure in favor of historically lower income earners. Thus, while the absolute dollar level of benefits is greater for the historically higher income earner, the imputed rate of return for the historically lower income earner is greater.¹¹ In this research the computed ratios of valuated expected benefit streams to compounded contribution streams permit evaluation of the hypothesized benefits of the incorporation of the social adequacy

⁹Martha N. Ozawa, Social Security (New York, 1975), pp. 3-4.

¹⁰According to Derthick, the principle of social adequacy has become the dominant operating principle of social security. However, the author makes this statement without empirical justification. See Derthick, p. 215. This research presents the empirical data needed to evaluate the historical and contemporary posture of the operating principles.

¹¹See Derthick, p. 215 and Mitchell, p. 5.

principle into the social security benefit structure. Computed differences between the two valuated streams permit evaluation of the hypothesized benefits of the incorporation of the individual equity principle into the structure.

Another social security wealth distribution controversy pertains to the returns young covered workers expect to receive from social security vis-a-vis that of older covered workers. Many writers believe returns have constantly fallen as the system has matured.¹² The entrance of the social security program into its maturity phase means that it is possible that current and future retirees have contributed or will contribute to the program their entire working lives. This situation contrasts with that of the first retirees in 1940, who could have paid into the program as little as \$6 based upon earnings of \$300 (1.5 years of work) and could have received full benefits.¹³ Contemporary covered workers will be required to contribute to the program for at least ten years to be eligible for benefits and, combined with their employers'

¹²For example see June A. O'Neill, "Alternatives for Financing a Mature Social Security System," Financing Social Security, ed. Colin D. Campbell (Washington, D. C., 1979), p. 175 and Sherwin Rosen, "United States," The World Crisis in Social Security, ed. Jean-Jacques Rosa (San Francisco, 1982), p. 159.

¹³Rita Ricardo Campbell, "The Problems of Fairness," The Crisis in Social Security, ed. Michael J. Boskin (San Francisco, 1978), p. 129.

contributions, are currently (1988) paying 15.02% of their earnings to social security. Thus, the cost for contemporary retirees to receive benefits comparable to those of earlier retirees is much greater and the imputed rates of return are undoubtedly smaller. The situation is perceived as severe by some and prompted the following statement by Milton Friedman:

Retired persons currently enjoy a bonanza. But youngsters currently entering the system are getting a raw deal. . . . To finance the excess payment to the growing number of retired, taxes have to be raised repeatedly. As a result the benefits promised younger workers are much smaller than the equivalent of the taxes paid on their wages.¹⁴

Friedman's statement implies three distinct ideas. First, since Friedman uses the phrase, excess payment, he implies older retirees are receiving more than a fair return from investment in social security. This excess payment is a "windfall" effect, which means earlier retirees are able to enjoy full benefits with abbreviated investment horizons. Second, the excess return is at the expense of current covered workers' disposable income since taxes have to be raised repeatedly. Finally, current covered workers should not expect excess returns of the magnitude received by current retirees. In this research if excess returns

¹⁴Milton Friedman, "On Social Security," Newsweek, April 3, 1967, p. 81.

exist, they are identified, their patterns are examined, and policy implications are indicated.

Politically, the indicated policy actions will be difficult to implement because they may involve curtailment of benefit levels. A recent example demonstrating the political unpopularity of a curtailment of benefits involves a group known as "notch babies." Notch babies are those persons born in the years 1917-21. In 1972, legislators made a technical mistake when they attempted to adjust benefits for inflation. Their adjustment involved amendments to both benefit formulas as well as to benefit amounts. Congress corrected this error in 1977 amendments by phasing in lower benefits over a four year period for retirees who were born in the period 1917-21, the notch babies. Persons born after 1921 receive none of the benefits of the technical error. The response to this correction has been enormously negative.¹⁵ Thus, as evidenced by contemporary events, it can be expected that any curtailment of benefits will be politically unpopular.

A final imbalance in the distribution of wealth controversy examined in this study pertains to the relative treatment of retired male workers vis-a-vis that of retired

¹⁵Robert A. Rosenblatt, "'Notch Babies' Plan Mass Protests Over Social Security Issue," Cincinnati Enquirer, March 22, 1987, Sec. D, p. 6.

female workers.¹⁶ The data generated in this study is analyzed to detect any differences; where found, an analysis of the cause(s) is presented. Ex ante one should expect to find differences in treatment because retired female workers live longer on average than do comparable retired male workers, a fact which impacts the expected benefit horizons and, subsequently, the valuation of expected benefit streams.

In summary, this research values social security contribution streams and associated expected benefit streams and examines the proposition that social security retirees could have earned larger retirement annuities had they been allowed to invest in market alternatives. These valuations are done within a theoretical framework which assumes expected benefit streams are risk-free. Relative valuations are computed and analyzed to detect treatment differences between various groups. The anticipated findings are: (1) investment in social security is a better alternative to investing in the risk-free funds for all covered workers, (2) investment in the market alternatives is less beneficial for covered female workers than it is for their male counterparts, (3) investment in the market alternatives is less beneficial for earlier

¹⁶In this research only individuals who are able to retire because of their own covered employment are examined. Some beneficiary types excluded from this study are widows and widowers, parents, and spouses.

retirees than it is for comparable later retirees, (4) when measured by dollar returns, investment in social security is more beneficial for higher income earners than for comparable lower income earners, and (5) when measured by rates of return, investment in social security is more beneficial for lower income earners than for comparable higher income earners.

In Chapter II literature relevant to the goal(s) of this research is reviewed. Chapter III contains the development of the propositions to be examined, while Chapter IV describes the methodology and data for examining the propositions. Finally, Chapter V presents the results, their analyses, and their policy implications.

CHAPTER II

LITERATURE REVIEW

Previous efforts to value social security benefits relative to social security contributions are discussed in this chapter. Additionally, writings which address the concept of fair return in the context of social security are evaluated.

Previous efforts to value social security benefits relative to social security contributions have utilized two types of valuation techniques: those that explicitly consider the time value of money and those that do not. Included in the latter category are two specific methodologies: the ratio of total benefits to total contributions¹⁷ and the ratio of benefits in the year of retirement to earnings in the year preceding retirement¹⁸ (the replacement ratio). The valuation techniques that do not consider the time value of money are technically

¹⁷For an example of this method see John A. Svahn, "Excerpts from Remarks by The Honorable John A. Svahn, Commissioner of Social Security, Before The American Association of Retired Persons," SSA Program Circular, Report No. 883, Sec. Press. (June, 1982), p. 3.

¹⁸For an example of this method see Alicia Munnell, The Economics of Private Pensions (Washington, D. C., 1982), p. 22 and Edward Cowan, "Background and History: The Crisis in Public Finance and Social Security," The Crisis in Social Security, ed. Michael J. Boskin (San Francisco, 1978), pp. 9-11.

insufficient¹⁹ and fail to consider alternative investment opportunity sets. Therefore, the findings obtained using these techniques will not be discussed. The omission of detailed discussion should not mislead the reader into believing these techniques are little used; indeed, their usage is pervasive throughout the literature.

The discussion in this chapter will focus on results obtained by using the category of techniques that explicitly considers the time value of money. Included in this category are the benefit-cost ratio, the net present value, and the internal rate of return. Fortunately, there is a substantial volume of research which utilizes extensively these techniques in the valuation of social security benefit and contribution streams.

The relative valuation of social security benefits to contributions is a process fraught with difficulty.²⁰ The immense complexity of the social security program²¹ causes

¹⁹For a thorough discussion of this insufficiency see Onorato Castellino, "Income Redistribution Through Old-Age Pensions: Problems of Its Definition and Measurement," Public Finance, XXVI (1971), 460-461.

²⁰For example, see R. Glenn Hubbard, "The Financial Impacts of Social Security: A Study of Effects on Household Wealth Accumulation and Allocation," Monograph Series in Finance and Economics, Monograph 1983-3 (New York, 1983), p. 4.

²¹For an excellent discussion of the impact of the complexity of the social security program upon valuation processes see Robert S. Kaplan, "A Comparison of Rates of Return to Social Security Retirees Under Wage and Price

the valuation process to be difficult, and necessitates the formation of simplifying assumptions. Aspects of the program which need simplifying assumptions include:

(1) constitution of contributions, (2) representative work histories, (3) representative retirement ages, (4) representative retirement dates, (5) representative benefit horizons, (6) appropriate compounding and discounting rates, (6) constitution of benefits, (7) types of employment, and (8) gender.

In determining what constitutes contributions by covered workers, the researcher must know that employed individuals' contributions are matched dollar-for-dollar by their employers. If one accepts the view that employees bear the full burden of contributions made on their behalf, then one should assume all references to individuals' monetary inputs into the program include not only that indicated by tax records, but additionally, that made by employers. Most researchers assume employees bear the full burden of contributions made on their behalf.²² The direction of this assumption is critical because of its impact on the valuation of contributions.

Researchers must also decide which representative work histories to analyze because the majority of covered

Indexing," Financing Social Security, ed. Colin D. Campbell (Washington, D. C., 1979), pp. 126-132.

²²See Onorato, pp. 457-458 for a discussion of this issue.

workers do not have continuous, uniform work histories. To analyze each individual work history would imply an endless task; therefore, representative work histories are chosen.

Representative retirement ages also must be chosen. Eligible workers can retire at monthly increments anytime after attainment of age 62. Most relative valuations of benefits to contributions occur at an assumed retirement age of 65, the date at which no reduction in benefits occurs. A strong caveat is indicated by choosing age 65 as the representative retirement date because individuals who retire before age 65 are treated more favorably than those who retire after age 65. For example, if an eligible worker retires at age 62, the nominal monthly benefit is 80% of what would be received if retirement occurred at age 65. However, if retirement is postponed until age 68, the nominal monthly benefit is at most 103% of what would have been received at age 65. The reduction in benefits is considered actuarially fair whereas the increase in benefits is not.²³

Decisions about representative retirement dates must be made. Since benefits were first paid by social security, over 500 possible dates of retirement have occurred. One must decide whether to sample or to examine

²³For a discussion of this issue see Vincent P. Crawford and David M. Lilien, "Social Security and the Retirement Decision," Quarterly Journal of Economics, XCVI (August, 1981), 513-515.

the entire population of possible retirement dates. If sampling is done, one must be concerned about omission of important data.

Benefit horizons for retired workers differ because of variations in mortality experiences. Therefore, one must choose representative benefit horizons or resort to stochastic models of benefit horizons. Typically, researchers choose benefit horizons that match the life expectancy of the retired worker's gender and retirement cohort.²⁴

Appropriate compounding rates applied to the valuation of contributions and appropriate discounting rates applied to the valuation of benefit streams must be selected. The selection of these values has been formidable for some researchers.²⁵ The proper selection can be made by examining the nature of the contribution and benefit streams. If a researcher wants to examine the performance of social security against some external criteria, then the values of the compounding rates are indicated. If one

²⁴For an example of research that utilized stochastic benefit horizons see Yung-Pin Chen and Kwang-Wen Chu, "Tax-Benefit Ratios and Rates of Return Under OASI: 1974 Retirees and Entrants," The Journal of Risk and Insurance, XXXI (1974), 192-193 or Alan Freiden et al., "Internal Rates of Return to Retired Worker-Only Beneficiaries Under Social Security, 1967-70," Studies in Income Distribution, No. 5 (Washington, D. C.: 1976), pp. 11-13.

²⁵For example see Joseph A. Pechman et al., Social Security: Perspectives for Reform (Washington, D. C., 1968), pp. 233-234.

accepts the belief that social security benefits are risk-free²⁶ then the values of the discounting rates are indicated.

To decide what constitutes benefits, researchers use either an individual or family approach. When using an individual approach, only those benefits paid directly to the retired worker are considered to constitute the benefit stream. When using the family approach, all benefits paid based on a retired worker's contribution history are considered to constitute the benefit stream.²⁷ Whether a researcher uses an individual approach or a family approach is critical because of its impact on the valuation of benefit streams.

The researcher must decide which type(s) of social security benefits to analyze. To examine retirement benefits only, adjustment must be made for other types paid. The confounding type is survivor's benefits because

²⁶For a discussion of the risk-free nature of social security benefit streams see Aaron, pp. 75-78, P. A. Diamond, "A Framework for Social Security Analysis," Journal of Public Economics, VIII (1977), p. 279, Martin Feldstein, "Should Private Pensions Be Indexed?," Financial Aspects of the United States Pension System, eds. Zvi Bodie and John B. Shoven (Chicago, 1983), pp. 219-220, Martin Feldstein, "Social Security," The Crisis in Social Security, ed. Michael J. Boskin (San Francisco, 1978), pp. 18-21, and Kaplan, pp. 132-133.

²⁷For a discussion of the family approach see Carol T. F. Bennett, "The Social Security Benefit Structure: Equity Consideration of the Family as Its Basis," American Economic Review Proceedings, LXIX (May, 1979) 227-231.

no distinct survivor's trust fund is maintained. Most researchers set aside a percentage of contributions as though it were placed in a survivor's trust fund.²⁸ Others assume the problem away.²⁹

There are two types of covered employment in social security: self-employment and nonself-employment. For the same historical level of earnings, the contributions made by a self-employed individual are only 75% of those made by an employed worker and the worker's employer. Additionally, self-employed individuals were not covered by social security until 1950.

The gender of workers will impact the valuation of benefit streams for at least two reasons. First, female retirees, on average, live longer than comparable male retirees. Second, retired female workers have been treated favorably since the method of calculating their retirement benefits, at one time, resulted in amounts higher than those of comparable male retirees. Most research does examine the treatment by social security of female workers relative to that of male workers.

The previous discussion summarizes the complexity that faces every researcher. The direction of the chosen

²⁸For example, see Pechman, et al., p. 236.

²⁹For example, see Chen and Chu, pp. 191, 193 and Kaplan, pp. 127-128.

assumptions can significantly alter the results in any study.

Before exemplary valuation research is examined two other research issues are discussed. First, there is an implied relative valuation of collective benefits to collective contributions for any retirement cohort and an implied relative valuation for individuals composing that retirement cohort.³⁰ The cohort approach to valuation allows comparison of the relative treatment of one generation of retirees to another. The worth of such comparisons is severely limited because it does not permit examination of whether social security has treated various groups of individuals composing cohorts differently. Limitations of the cohort approach force researchers to resort to the individual valuation approach; it makes possible intra-cohort and inter-cohort comparisons of specific homogeneous groups composing the cohorts. Such analysis is important because, in addition to illuminating other issues, it offers insight into which principle has dominated the operation of social security, social adequacy or individual equity.

³⁰For a discussion of the cohort approach see Carolyn L. Weaver, "The Economics and Politics of the Emergence of Social Security: Some Implications for Reform," The Cato Journal, III (Fall, 1983), pp. 363-364. For a discussion of the individual approach see O'Neill, pp. 175-177.

The second critical valuation issue pertains to what constitutes contributions: only those that a covered worker actually makes or all those that support the covered worker's benefit stream. Since social security is operated as a pay-as-you-go system, in theory, all current contributions are paid out as current benefits. Most valuation studies use contributions that covered workers actually make (the insurance approach) instead of those that are made to support the potential retiree's benefit stream. A notable exception was the seminal study done by Feldstein.³¹

Specific literature discussions will be presented according to the technique employed. Only those research findings pertinent to this research will be discussed.

A popular valuation technique is the benefit-cost ratio.³² The benefit-cost ratio for an individual is found by discounting benefits to the date of retirement and dividing this value by contributions compounded to the date of retirement. This valuation technique is technically correct because it explicitly considers the time value of money and examines all relevant cash flows. The benefit-

³¹Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," Journal of Political Economy, 82 (October, 1974), pp. 905-926.

³²For a discussion of this methodology see George C. Philippatos, Financial Management: Theory and Techniques (San Francisco, 1973), pp. 115-119 or any standard financial management text.

cost ratio indicates the amount of benefits each dollar of contributions generates at the point of retirement. From the individual's perspective, the more this ratio exceeds unity, the better.

Using ex post data Campbell and Campbell demonstrate a positive effect of a decline in historical earnings upon benefit-cost ratios for 1967 male retirees and a positive effect of an increase in historical earnings upon absolute dollar levels of benefits for this same group.³³ They also demonstrate positive effects upon benefit-cost ratios when a family approach is used instead of an individual approach.³⁴ Using ex ante data the authors project similar results for males expecting to retire in 2010.³⁵ Using both ex post and ex ante data the authors find later retirees have experienced, or will experience, a deterioration in benefit-cost ratios vis-a-vis that of earlier retirees.³⁶

A critical assumption made in the study by Campbell and Campbell pertains to the values used for compounding contributions and discounting benefits. The compound rates

³³Colin D. Campbell and Rosemary G. Campbell, "Cost-Benefit Ratios Under the Federal Old-Age Insurance Program," Old Age Assurance, ed. John R. Stark (Washington, D. C., 1967), p. 74.

³⁴Ibid.

³⁵Ibid., p. 77.

³⁶Ibid., pp. 74, 77.

used were yields on series E-bonds until 1963 and yields on savings deposits thereafter.³⁷ Since retirement dates examined were 1967 and later, discount rates used were yields on savings accounts.³⁸ The authors chose these rates to represent the current yields from alternative investment opportunities; it was their intent to place a market value on the contribution and benefit streams. Another noteworthy point is that the same rates were applied to both the contribution and benefit streams; no explicit consideration was given to the risk profiles of either type of stream.

The findings of Campbell and Campbell support two popular contentions about the social security program. First, social adequacy and individual equity are both part of the operating philosophy of the present social security system. Second, certain groups of early retirees have been treated more favorably than subsequent comparable ones.

The results of Campbell and Campbell are supported by the research of Chen and Chu.³⁹ Examining 1974 retirees by using an "annuity certain" (nonstochastic benefit horizon) approach and a "life annuity" (stochastic benefit horizon) approach they observe the same effect of historical

³⁷Ibid., p. 79.

³⁸Ibid.

³⁹Chen and Chu, pp. 189-206.

earnings and family status on benefit-cost ratios as did Campbell and Campbell.⁴⁰ In comparing 1974 retirees' benefit-cost ratios to those expected by 2017 and 2021 retirees, a strict deterioration in the ratios is projected for later retirees.⁴¹

A major weakness in the Chen and Chu study is inadequate attention devoted to the derivation of the compounding and discounting rates. They used a constant 3% value for both the compounding and discounting rates without any economic justification for this choice. Aside from this weakness, the balance of the study was well conceived and implemented.

Further support is given to the Campbell and Campbell study by Pechman, et al.⁴² Their findings support the adverse effect of increases in historical levels of earnings on benefit-cost ratios and propitious effects of the family approach upon the ratios.⁴³ Additionally, Pechman, et al., find that female retirees have enjoyed better benefit-cost ratios than their male counterparts.⁴⁴

⁴⁰Ibid., pp. 196, 201.

⁴¹Ibid., pp. 201-205.

⁴²Pechman, et al., pp. 231-250.

⁴³Ibid., pp. 237-246.

⁴⁴Ibid.

Choosing the appropriate compounding and discounting rates proved a formidable task for the researchers. They gave these rates two meanings: the rate of time preference of consumption and the best market yield available to investors.⁴⁵ Recognizing that these rates probably do not coincide, a range of rates from 3% to 10% was assigned. Increases in the rates had an adverse effect upon the benefit-cost ratios.⁴⁶

A more recent study by Myers and Schobel⁴⁷ supports the results of previous studies. The benefit-cost ratios for women have been, and will continue to be, better than those for men,⁴⁸ the family approach results in ratios superior to those obtained by using the individual approach,⁴⁹ historically high income earners have had smaller ratios than comparable lower income earners,⁵⁰ and the ratios of later retirees have been inferior to those of comparable earlier retirees.⁵¹

⁴⁵Ibid., pp. 233-234.

⁴⁶Ibid., pp. 237, 239, 242-243, 246.

⁴⁷Robert J. Myers and Bruce D. Schobel, "A Money's Worth Analysis of Social Security Retirement Benefits," Transactions, (1983), 31-43.

⁴⁸Ibid., pp. 39, 41.

⁴⁹Ibid.

⁵⁰Ibid.

⁵¹Ibid.

The compounding rates chosen by Myers and Schobel were values assumed to be available on special social security trust fund investments. Apparently no actual data exist on these special trust fund investments for the period 1937-1950; therefore, the authors selected 2.25% as the compounding rate for this period. Actual rate experiences on these special trust fund investments were used for 1951-1981, and projected rates were used for 1982 and afterwards. The discount rates used were a constant 2%, an estimate of the real rate of interest.⁵²

A technique used to calculate intergenerational transfers is the net present value where positive values are interpreted as intergenerational transfers. The net present value is found by subtracting the valuation of contributions from the associated valuation of benefits. The technique is technically sufficient because it considers all cash flows and recognizes the time value of money. Ozawa calculated intergenerational transfers for 1962-73 retirees who had followed maximum and 50% of maximum earnings paths.⁵³ All retirees in Ozawa's study enjoy positive intergenerational transfers. However, historically high income earners experience the greatest transfers, a result which supports the realization of the

⁵²Ibid., pp. 32-33.

⁵³Ozawa, p. 9.

hypothesized benefits of the incorporation of the individual equity principle into the social security benefit structure. Further examination of Ozawa's data reveals that if valuated benefit streams are divided by valuated tax streams (benefit-cost ratios), then the historically low income earner enjoys larger ratios than comparable higher income earners. This finding supports the realization of the hypothesized benefits of the incorporation of the social adequacy principle into the social security benefit structure. Another significant finding is that even though a general decline occurs over time in the percentage composition of total benefits by intergenerational transfers, this trend is not absolute.

The computation of intergenerational transfers is sensitive to compounding and discounting rates. Ozawa used a constant 3%, the rate of real growth assumed for the economy during the study period.⁵⁴ Ozawa did not state why the real rate of economic growth was chosen as the compounding and discounting rates. The basis of choice may be a theory of interest rates which states that all interest rates consist of multiple components. One component is the "pure interest rate" which is often referred to in the literature as the "risk-free interest

⁵⁴Ibid., pp. 7-8.

rate."⁵⁵ The pure interest rate consists of a real component and a price component. The real component is supposed to mirror changes in real economic growth. Ozawa compounded contributions at rates equal to the assumed real growth rate of the economy plus actual inflation rates. (The sum of these two is the pure rate of interest.) Thus, Ozawa implies the proper method of valuing contributions is to use risk-free rates. A question remains as to why she assumed a constant rate over the study period instead of using readily available ex post gross national product data to use as an approximation for real economic growth. Note the study did use actual inflation rates as part of the compounding values.

The use of a constant real component as part of the compounding rates is one of many weaknesses in the Ozawa study. Others pertain to the period of compounding (years instead of quarters or months) and to the use of a cohort approach instead of an individual approach. Despite its many weaknesses, the study is significant because it is one of few which recognizes (even though implicitly) that proper valuations of contributions should utilize risk-free rates since associated benefit streams are risk-free.

⁵⁵For a discussion of this theory see Edward D. Zinbarg, "Modern Approach to Investment Risk," Readings in Financial Management, eds. David E. Scott, Jr., et al. (New York, 1982), pp. 75-76.

Another effort at computing intergenerational transfers was done by Parsons and Munro.⁵⁶ The results obtained by the authors are similar to Ozawa's. In addition, the study shows retired female workers receive greater intergenerational transfers than do male counterparts, and even though the percentage composition of total aggregate benefits by intergenerational transfers has declined, the absolute dollar value has increased.⁵⁷ A distinguishing characteristic of this study is the values assigned the compounding and discounting rates; yields from short-term commercial paper were used.⁵⁸

The final technique employed by researchers is the internal rate of return. The internal rate of return causes the valuation of contributions at retirement to equal the valuation of benefits at retirement. The strength of this method is that it considers all relevant cash flows and recognizes the time value of money. In an examination of retirees during the period 1967-1970, Freiden, et al., found that retired female workers have higher internal rates of return than their male counterparts, and the internal rates of return for each

⁵⁶Donald O. Parsons and Douglas R. Munro, "Intergenerational Transfers in Social Security," The Crisis in Social Security, ed. Michael J. Boskin (San Francisco, 1977), pp. 65-86.

⁵⁷Ibid., pp. 75-78.

⁵⁸Ibid., p. 191.

gender declines the later age 65 retirement occurs during the study period.⁵⁹ Additionally, as historical earnings increase, internal rates of return decline.⁶⁰

In summary, the findings of the extant research support the contentions that the social security benefit structure favors retired female workers more than their male counterparts, retirees with dependents more than those without dependents, earlier retirees more than later retirees, in absolute dollars, high income earners more than lower income earners, and, in rates of return, low income earners more than higher income earners. In most cases, the major weakness of the research pertains to the choices of compounding and discounting rates used in valuations of contribution and benefit streams.

Crucial to this study is the concept of "a fair return" in the context of the social security program. There should be some external criterion against which returns from investment in social security can be adjudged fair. The absence of a consensus regarding this criterion has not prevented some from describing monthly social security benefits as consisting of two components: a

⁵⁹Freiden, et al., p.17.

⁶⁰Ibid., p. 21.

welfare component and an earned component.⁶¹ In the literature it is common to observe the welfare component described as intergenerational transfers; thus, intergenerational transfers represent dollar returns in excess of a fair return.

As has been emphasized previously, an external norm for the measurement of fairness exists, at least theoretically. If one accepts the risk-free nature of social security benefits, then one would acquiesce to the contention that a fair return norm would be the returns experienced from investment in the risk-free fund. One of few authors to recognize this external norm of fairness is Kaplan.⁶² Kaplan does not commit totally to this norm because real risk-free rates, as approximated by the real returns on United States Treasury bills, historically have been close to zero.⁶³

The major operational difficulty in using returns from the risk-free fund as an external norm is identifying the risk-free fund or a suitable surrogate for it. This has been a formidable, if not impossible, task for

⁶¹For an example of this division of social security benefits see Richard Greene, "On the Dole?," Forbes, (March 14, 1983), 44.

⁶²Kaplan, pp. 132-133.

⁶³Ibid.

researchers.⁶⁴ In practice, two market funds, Treasury bills and Treasury bonds, are used as surrogates for the risk-free fund. Included in the hypothetical collection of investment alternatives discussed in Chapter I are Treasury bills and Treasury bonds. Interpretation of results using these two funds recognizes their shortcomings as surrogates for the risk-free fund. In addition to comparing the performance of investment in social security to that of investment in the risk-free fund, comparisons should be made to the performance of external risky norms. The underlying logic of such comparisons is that they permit examination for the "over-performance" of investment in social security. Findings of over-performance would indicate abnormalities in the social security payment structure because beneficiaries are compensated for risk not undertaken.

⁶⁴For a discussion of the problems involved in identifying appropriate risk-free surrogates see Eugene F. Brigham, Financial Management: Theory and Practice, third edition, (New York, 1985), pp. 279-281.

CHAPTER III

ANALYTICAL GOALS⁶⁵

The suggestion by social security scholars (and others) that some retired social security workers may have enjoyed larger retirement annuities had they been permitted to invest identical amounts contributed to the social security program in alternative investments is empirically examined in this research. This examination is implemented by assuming that social security, at the time of initial contributions collection (1937), offered covered workers a collection of investment alternatives. Each covered worker was permitted to select a single alternative from this collection, and all of the worker's subsequent social security contributions were assumed to have been placed in the chosen alternative.

An important issue pertains to the assumed composition of the collection of investment alternatives offered by social security. Given the number of real and financial assets and their linear combinations, infinite possibilities could have been included. Deciding the composition of this collection may seem intractable initially; however, the concept known as two-fund

⁶⁵Much of the material in this chapter pertaining to research methodology draws heavily from the work of C. William Emory, Business Research Methods (Homewood, Il., 1976), pp. 20-45.

separation⁶⁶ can aid in the decision-making process.

According to two-fund separation, an individual investor has a utility maximizing portfolio which is a linear combination of the market portfolio of risky assets and the risk-free asset. Thus, while the number of possible investment alternatives is still infinite (because of linear combinations), the choices are always linear combinations of only two assets, the risk-free asset and the market portfolio of risky assets.

Therefore, the assumed composition of the collection of investment alternatives should include surrogates for the risk-free asset and for the market portfolio of risky assets. Additionally, linear combinations of the surrogates for the risk-free asset and the market portfolio of risky assets should be included. In this research conventional market benchmarks are included as surrogates for the risk-free asset and for the market portfolio of risky assets. In particular, United States Treasury bills and Treasury bonds⁶⁷ are used as surrogates for the risk-

⁶⁶For a discussion of two-fund separation three sources are recommended. The standard reference is J. Tobin, "Liquidity Preference as a Behavior Towards Risk," The Review of Economic Studies, February, 1958, pp. 65-86. For a textbook format see either George C. Philippatos and William W. Sihler, Financial Management: Text and Cases, (Boston, 1987), p. 201 or Thomas E. Copeland and J. Fred Weston, Financial Theory and Corporate Policy, second edition, (Reading, Ma., 1983), p. 174.

⁶⁷The use of Treasury bonds as a surrogate for the risk-free fund is a questionable procedure because these

free asset, while the Standard and Poor's 500 (S & P 500) Composite Index and the Center for Research on Security Prices' (CRSP) Value Weighted Index are used as surrogates for the market portfolio of risky assets.⁶⁸ Thus, the choices assumed to have been included in the hypothetical collection of investment alternatives are Treasury bills and bonds, the S & P 500 Composite Index, the CRSP Value Weighted Index, and a portfolio consisting of equal investments in Treasury bills and the S & P 500 Composite Index.

In this research, homogeneous groups of retired social security workers are examined. When relative valuations of expected benefits to associated contributions are made for a particular group, the results apply to all members composing the group. Additionally, the calculated relative valuations are population parameters. This implies that the central proposition of this study, that some retired

instruments have long terms to maturity. Their ex post real returns are subject to large fluctuations which are caused by price risk and unanticipated inflation. Thus, while Treasury bonds have essentially no default risk, their returns are still subject to other types of risk. The use of Treasury bonds as a surrogate for the risk-free asset is done at the recommendation of Eugene F. Brigham. See Brigham, pp. 279-281.

⁶⁸Each of the surrogates used for the market portfolio of risky assets is a value-weighted index, a characteristic possessed by the true market portfolio of risky assets. Additionally, each of these surrogates assumes that dividends are reinvested back into the surrogate; that is, there are no money payoffs from investing in the surrogates until retirement. Also, investment amounts placed in all surrogates are assumed to accumulate tax-free.

social security workers could have had larger retirement annuities had they been allowed to invest social security contributions in alternative investments, can be examined without hypothesis testing.

In addition to examining the alternative investment proposition, others are examined. Among these are propositions which state that the social security benefit structure favors: (1) retired female workers more than their male counterparts, (2) earlier retirees more than comparable later retirees, and (3) historically lower income earners more than comparable higher income earners.

The last proposition is examined by decomposing it into two component propositions. The first is related to the incorporation of the social adequacy principle into the social security benefit structure. Specifically, this incorporation is supposed to result in higher imputed rates of return for historically lower income earners. The second is related to the incorporation of the individual equity principle into the social security benefit structure. Specifically, this incorporation is supposed to result in higher dollar returns for historically higher income earners.

CHAPTER IV

METHODOLOGY AND DATA

This chapter describes the research model used to examine the propositions stated in Chapter III. The description of the model includes simplifying assumptions, their implications, and specific research techniques. After the discussion of the model the data is presented.

Model

The major goal of this research is the examination of the proposition which states that had contributions made to the social security program been placed in alternative investments, then some retirement annuities would be larger than those offered by social security. Given this goal, only assumptions pertaining to relative valuations of expected social security benefits and associated contributions need be made.

The following assumptions are part of the research model:

1. The expected real level of benefits for all retired social security workers⁶⁹ is constant from the month of retirement and is risk-free.

⁶⁹A retired social security worker is an individual who has retired as a result of having worked the requisite length of time in covered employment and at the requisite level of covered employment.

2. No retired social security worker has ever drawn any other type of social security money benefits. Additionally, no survivor or auxiliary benefits are payable.

3. Each worker who contributes to the social security program was born in January and retires upon attainment of age 65.

4. Each retired social security worker examined will have experienced a continuous, uniform work history as an employee starting with 1937 and will have worked only in employment covered by social security.

5. Total contributions include those made by the covered employee and those made by the covered employee's employer.

6. Each retired worker's mortality experience matches the ex ante expectations (formed at the time of retirement) of the retired worker's gender and retirement cohort.

7. There are no income taxes in the social security world.

8. Social security offers all covered workers a selection of investment alternatives to which they can choose to direct their contributions. Once a choice is made by covered workers no change can be made.

The impact of assumption one is to establish real levels of risk-free benefits for social security retirees. Once an eligible worker⁷⁰ retires, month-to-month benefits are constant in real terms and will be paid throughout the individual's retirement horizon.

Assumption two implies that the only relevant type of benefits used in the valuation of expected benefit streams

⁷⁰An eligible worker is one who has worked long enough in social security covered employment and at levels large enough to qualify for retirement benefits.

is retirement benefits. By implication, all contributions to the Old Age and Survivors Insurance (OASI) trust fund are assumed to support benefits for retired social security workers. Factored out of this study are the impacts of survivor, auxiliary, disability, hospital, and pre-retirement social security money benefits.⁷¹

Assumption three is significant because it partially defines covered workers' social security investment and benefit horizons (the ending and beginning of each, respectively). This assumption also identifies retirement dates to be examined. Another implication is that since retirement is assumed to occur only at age 65, there will be neither decreases in retirement benefits because of early retirement nor increases in retirement benefits because of delayed retirement.⁷²

Assumption four impacts retired workers' social security investment horizons. In this study all covered workers have investment horizons with the same beginning

⁷¹Separate trust funds are maintained for the disability and healthcare programs administered by social security. Specified amounts of contributions are set aside for these funds.

⁷²Early retirement for eligible workers is when retirement occurs before age 65. Early retirement results in reduction of nominal benefits compared to what would be received if retirement occurred at age 65. Delayed retirement for eligible workers is when retirement occurs after age 65. Delayed retirement results in increases in nominal benefits compared to benefits received had retirement occurred at age 65.

date (1937). Assumption four factors out of this study the consideration of self-employed workers.

Assumption five is significant because of its impact on contribution streams. For valuation purposes this research considers as relevant contributions not only those reflected on covered workers' tax records, but also, those made by covered workers' employers as a result of the covered workers' employment.

Assumption six helps to establish social security retirement horizons. By implication these horizons are nonstochastic. Another implication of this assumption is that the relevant life expectancy for a retired social security worker is that observed at the worker's date of retirement.

Assumption seven is significant because it has a positive impact on valuations of both contribution and expected benefit streams. This assumption factors out the impact of income taxes.

Assumption eight is of paramount importance in this research; it directly impacts valuations of contribution streams. The valuations are a function of investment alternatives chosen by individuals. This assumption precludes movement from one investment alternative to another; therefore, the choice made at the beginning of an individual's covered employment is permanent.

Specific techniques employed in this research are the benefit-cost ratio (BCR) and the net present value (NPV). A BCR and NPV are calculated for each individual examined. Specifically, the following values are calculated:

$$BCR_{jT} = \frac{b \times \sum_{t=1}^L \left[\prod_{z=1}^t \frac{1}{(1 + R_{Fz})} \right]}{\sum_{t=1}^T C_t \left[\prod_{k=t+1}^T \frac{(1 + r_k)}{(1 + I_k)} \right]}; \quad (1)$$

and

$$NPV_{jT} = b \times \sum_{t=1}^L \left[\prod_{z=1}^t \frac{1}{(1 + R_{Fz})} \right] - \sum_{t=1}^T C_t \left[\prod_{k=t+1}^T \frac{(1 + r_k)}{(1 + I_k)} \right]; \quad (2)$$

Where:

BCR_{jT} is the benefit-cost ratio for individual j retiring at time T ;

b is the real monthly benefit amount that individual j retiring at time T will receive;

L is the expected benefit horizon in months of individual j retiring at time T ;

z is a specific month in the benefit horizon of individual j retiring at time T ;

R_{Fz} is the real risk-free rate applicable in month z ;

T is the end of individual j 's social security investment horizon and the beginning of individual j 's social security benefit horizon;

C_t is the real contribution amount made in quarter $t=k$ by individual j retiring at time T ;

k is a specific quarter in the social security investment horizon of individual j retiring at time T ;

r_k is the nominal rate being used to value contributions in quarter k ;

I_k is the inflation rate in quarter k and;

NPV_{jT} is the net present value for individual j retiring at time T ;

The numerator of equation (1) and first term of the right hand side of equation (2) represent the valuation at time T of expected real social security benefits for individual j , where the valuation is made utilizing projected real risk-free rates. The denominator of equation (1) and the second term of the right hand side of equation (2) represent the valuation at time T of the real contributions associated with the benefit stream for individual j retiring at time T . The valuation of the contribution streams is made utilizing real rates implied by the chosen investment alternatives.

Data

Tables A-1, A-3, A-5, A-7, and A-9⁷³ contain valuations of real contributions for eligible workers retiring at age 65 in each of the years, 1940-1985. (These tables are derived from data contained in Tables A-2, A-4, A-6, A-8, and A-10 which will be discussed in detail.) Valuations found in Tables A-1, A-3, A-5, A-7, and A-9 are computed for covered workers who follow: (1) maximum earnings paths, (2) 75% of maximum earnings paths, (3) 50%

⁷³All data referred to in this section are found in the Appendix in Tables A-1 through A-30.

of maximum earnings paths, and (4) 25% of maximum earnings paths. Valuation rates used in each of these tables are, respectively: (1) Treasury bill yields, (2) Treasury bond yields, (3) S & P 500 Composite Index yields, (4) CRSP Value Weighted Index yields, and (5) yields from a composite portfolio consisting of equal investments in Treasury bills and in the S & P 500 Composite Index. These yields reflect the assumed alternative investments that were made available to covered workers at the beginning of their social security investment horizons. The choices assumed offered are guided by the two-fund separation principle which states that an individual, irrespective of risk preference, chooses as an investment portfolio some linear combination of the market portfolio of risky assets and the risk-free asset.

Two funds were chosen as surrogates for the risk-free asset: United States Treasury bills and United States Treasury bonds. Neither of these are perfect surrogates for the risk-free asset because both are inherently risky.⁷⁴ However, conventional research (and this research) utilizes them as surrogates primarily because they are default-free, a quality that the risk-free asset possesses.

⁷⁴For a discussion of this inherent risk see Brigham, pp. 279-281.

Two funds were chosen as surrogates for the market portfolio of risky assets: The S & P 500 Composite Index and the CRSP Value Weighted Index. Like the surrogates used for the risk-free asset, the two chosen for the market portfolio of risky assets are inherently weak. This weakness is caused by the failure of the surrogates to contain all components of the market portfolio of risky assets, a weakness discussed thoroughly by Roll.⁷⁵ The market portfolio surrogates chosen for this study are those used by conventional researchers. A feature which makes them appealing is their value-weighted characteristic; this characteristic is possessed by the true market portfolio of risky assets.

The Treasury bill, Treasury bond, S & P 500 Composite Index, inflation, and Consumer Price Index (CPI) data used in this study are taken from an often quoted source by Ibbotson Associates.⁷⁶ The CRSP Value Weighted Index data were obtained on May 15, 1986, through The University of Tennessee at Knoxville's Computer Files.

⁷⁵Richard Roll, "A Critique of the Asset Pricing Theory's Tests," Journal of Financial Economics, (March, 1977), 129-176.

⁷⁶Ibbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), pp. 127, 124, 119, 128, and 145, respectively.

Tables A-2, A-4, A-6, A-8, and A-10 contain valuated contributions (and the inputs⁷⁷ used to calculate them) for covered workers following maximum earnings paths. To read these tables, note that social security contributions are paid at the end of each quarter. Thus, the value of compounded contributions in any quarter is found by taking the previous quarter's cumulative compounded value, multiplying it by one plus the relevant total security yield (nominal rate) for the current quarter, dividing this amount by one plus the inflation rate for the current quarter,⁷⁸ and finally, adding this amount to the real contributions made at the end of the current quarter. For example, in Table A-2, the compounded value for the second quarter of 1938, 88.29, is found by evaluating the following expression:

$$73.62(1.0001)/(1.000) + 14.66.^{79}$$

⁷⁷The compounding values and inflation rates shown in Tables A-2, A-4, A-6, A-8, and A-10 are derived from data bases which display data on a monthly basis. To derive the quarterly data shown in these Tables, the values of one plus the monthly rate for each of the three months composing a particular quarter is found. Next, the product of these three values are obtained. From each of these products one is subtracted to obtain the rate shown in the tables for each quarter.

⁷⁸The reader should note that by dividing contributions compounded using nominal rates by 1 plus the appropriate inflation rate, compounded values will always be in constant dollars.

⁷⁹The evaluations of some expressions presented in this chapter may yield values which differ a few cents from

Where:

73.62 is the cumulative real compounded (at Treasury bill yields) value of contributions through the end of the first quarter of 1938;

1.0001 is 1 plus the total Treasury bill yield (.0001) for the second quarter of 1938;

1.0000 is 1 plus the inflation rate (.0000) for the second quarter of 1938; and

14.66 is the real contribution amount made by a maximum earner at the end of the second quarter of 1938.

While Tables A-2, A-4, A-6, A-8, and A-10 contain valuated contributions for covered workers following maximum earnings paths (maximum contributors), Tables A-1, A-3, A-5, A-7, and A-9 contain valuated contributions for covered workers who follow maximum, 75% of maximum, 50% of maximum, and 25% of maximum earnings paths. The valuated contributions for covered workers who follow nonmaximum earnings paths is found by multiplying the entries for the maximum contributor by the appropriate percentage. For example, if a covered worker follows a 25% of maximum earnings path, then the 1985 entry found in Table A-1 for this worker, 2322.69, is found by multiplying the 1985 maximum contributor entry, 9290.76, by 25%. The nonmaximum contribution is a constant percentage of the per period maximum contribution.

Values to be compounded, that is, maximum real contributions found in the third column of Tables A-2,

the tabulated values. These variances may occur because input data presented in the tables are rounded.

A-4, A-6, A-8, and A-10 are derived using Tables A-11 through A-15. Table A-11 contains real quarterly contributions⁸⁰ made to the social security program (after administrative costs) for the years 1937-1984. Values in Table A-11 are obtained by deflating nominal values in Table A-12 by the appropriate quarterly price index value⁸¹ found in Table A-13. For example, the fourth quarter, 1952, maximum earnings case value found in Table A-11 (13.93) is computed by dividing the fourth quarter, 1952, maximum case value (26.43) found in Table A-12 by the fourth quarter, 1952, entry (1.897) found in Table A-13.

The nominal values shown in Table A-12 are found by using the data in Tables A-14, A-15, and A-16. Table A-14 contains various earnings paths being tested in this research. Table A-15 shows actual administrative costs (as a percentage of OASI tax collections) of operating the OASI programs. Table A-16 contains combined employer-employee contribution rates that support the OASI programs. Contribution rates that support programs other than OASI have been excluded from the totals in Table A-16.⁸²

⁸⁰Dollar values in this study are expressed in January, 1937 dollars. This base is used because this date is when social security contributions were first collected.

⁸¹Quarterly price index data are derived by averaging the price index for each of the months in a particular quarter.

⁸²To derive the percentage of contributions that supports the OASI programs is a simple task because the

Entries in Table A-12 are found by multiplying quarterly earnings in Table A-14 by corresponding contribution rates in Table A-16 and then multiplying these values by one minus the average of administrative costs in Table A-15 (.021 is the average value).⁸³ For example, the fourth quarter entry for the maximum case of 1946 (14.68) is found by evaluating the following expression:

$$750(.02)(1-.021)$$

Where:

750 is the maximum quarterly earnings for the fourth quarter, 1946;

.02 is the combined employer-employee contribution rate for the fourth quarter, 1946; and

1-.021 is the percentage of nominal contributions available for valuation after administrative costs.

Tables A-17 through A-30 are used to calculate present values of benefit streams associated with various contribution streams. Tables A-17 and A-18 contain

amounts that support programs other than OASI are specified. However, it is impossible to set aside the exact amounts that support the survivors portion of OASI since no separate trust fund is maintained for this program. Therefore, it is assumed in this research that all contributions that support the OASI programs support only the Old Age (retirement) portion of OASI. Interpretation of results recognizes the implication of this assumption.

⁸³Administrative costs are excluded from contributions. Even though it is assumed social security allows covered workers investment alternatives, there are still administrative costs associated with making available and managing these alternatives. It is assumed these costs are paid for in nominal dollars upfront, much like a front-end loading mutual fund.

discounted benefit streams for men and women, respectively. These tables were derived under the assumption that future real risk-free rates equal the average historical real yield on one-month Treasury bills.⁸⁴ Tables A-19 and A-20 also contain discounted benefit streams for men and women, respectively. These tables were derived under the assumption that future real risk-free rates equal the average historical growth rate of real gross national product (GNP).⁸⁵

To obtain the values in Tables A-17 through A-20, the real values of the various benefit streams must be derived. Tables A-21 and A-22 contain these needed real values for men and women, respectively. Real values in Tables A-21

⁸⁴This procedure was used to forecast real risk-free rates for two reasons. First, in this research Treasury bills are used as a surrogate for the risk-free asset. Therefore, the expected real yields on Treasury bills should be used as real risk-free discount rates. Second, since social security benefit horizons examined in this research are up to 230 months in length, then long-term real risk-free rates must be employed. Ibbotson Associates (See Ibbotson Associates, p. 76.) determined that the long-term real yield on Treasury bills drifts toward its historical average.

⁸⁵The employment of this procedure to forecast real risk-free rates is related to the theory of interest rates which states that the expected real risk-free component of interest rates is equal to the expected growth rate of real GNP. (See the discussion on pp. 26-27.) Since social security benefit horizons examined in this study are long-term, then the expected long-term growth rate of real GNP must be used to discount benefit streams. It is assumed in this research that the best estimate of the long-term growth rate of real GNP is the average historical growth rate of real GNP, the same assumption made in the Ozawa research (see Ozawa, p. 7).

and A-22 are derived by using data in Tables A-23 and A-24. Tables A-23 and A-24 contain nominal monthly benefits for men and women, respectively.⁸⁶ Deflating each of these values by the corresponding value in Table A-25, the January CPI,⁸⁷ leads to values found in Tables A-21 and A-22. For example, the entry for the 1985 male maximum earner retiree (95.77) is found by dividing the corresponding nominal value in Table A-23 (717.20) by the 1985 CPI (7.489) found in Table A-25.

The final values needed to calculate discounted benefit streams are the annuity values contained in Tables A-26 and A-27. These are found by evaluating the following expression:

$$1/r - 1/(r(1 + r)^t),$$

which is the valuation expression for an annuity. In this expression r is the applicable monthly discount rate and t is the number of expected payment months. Values for r are shown in Tables A-28 and A-29. The values in Table A-28 are derived by forecasting future real risk-free rates as

⁸⁶The data in these two tables were calculated especially for this study by Jack Spann, Reconsideration Specialist, Social Security Program Service Center, Birmingham, Al.

⁸⁷An assumption in this study is that benefits for all social security retirees are frozen at initial real levels. Since all retirees are assumed to retire in January of each year, then the January CPI must be used to calculate real monthly benefit amounts that will be in effect throughout a retired worker's benefit horizon.

the average historical real yield on one-month Treasury bills. The values in Table A-29 are derived by forecasting future real risk-free rates as the average historical growth rate of real GNP. Values for t are shown in Table A-30. In this study expected benefit horizons are equated with life expectancies (in months) beyond age 65 of the retirees' gender and cohort.

Discounted benefit streams in Tables A-17 and A-18 are found by multiplying corresponding entries in Tables A-21 and A-22 by corresponding annuity factors in Table A-26. For example, the 1985 maximum female entry found in Table A-18 is 21508.41. This value is found by multiplying the 95.77 entry in Table A-22 for the 1985 maximum case female retiree by the 224.58 entry found in Table A-26 for the 1985 female retiree.

Discounted benefit streams in Tables A-19 and A-20 are found by multiplying corresponding entries in Tables A-21 and A-22 by corresponding annuity factors in Table A-27. For example, the 1985 maximum female earner entry found in Table A-20 is 16726.16. This value is found by multiplying the 95.77 entry in Table A-22 for the 1985 maximum case female retiree by the 174.64 entry found in Table A-27 for the 1985 female retiree.

Tables A-1 through A-30 provide exactly the data needed for examining the propositions stated in Chapter III. The most important data are those contained in Tables

A-1, A-3, A-5, A-7, A-9, and A-17 through A-20. The data in these tables are used to calculate benefit-cost ratios and net present values. These calculations are presented and analyzed in Chapter V.

CHAPTER V

RESULTS, ANALYSIS, AND IMPLICATIONS

Results

Relative valuations of benefit streams to associated contribution streams which are necessary for the examination of the propositions stated in Chapter III are presented in a series of tables in this chapter. The tables are grouped into sets according to each assumed investment alternative used to value contributions and to the method employed to forecast risk-free rates that are used to value benefit streams. There are two sets for each assumed investment alternative, each consisting of four tables. The first set is derived assuming that risk-free rates are forecasted by the historical average of real yields on one-month Treasury bills. The second set is derived assuming that risk-free rates are forecasted by the historical average growth rate of real GNP. The first two tables of each set contain benefit-cost ratios for men and women, respectively. The last two contain net present values for men and women, respectively. Within each table are five columns; the first column contains years of retirement, which range from 1940 through 1985. (The reader should recall that by assumption, retirement occurs in January of each year.) The next four columns contain

relative valuations for those retirees who follow maximum, 75% of maximum, 50% of maximum, and 25% of maximum earnings paths, respectively. By assumption, covered workers being examined in this study are those who follow particular contribution paths with no deviations. This assumption may disturb some readers since few covered workers follow a contribution path without deviation. However, neither the integrity of this research nor its completeness is compromised by making this assumption. In this research the implied treatment by the social security benefit structure of hypothetically retired social security workers is being examined, not the treatment of actual retirees. Since there exist infinite possibilities for contribution paths, exemplary ones are chosen, and valuations of those not chosen are deduced. These deductions are made possible, hypothetically, by the incorporation of the operating principles of social adequacy and individual equity into the social security benefit structure. Social adequacy guarantees the ordinal placement of benefit-cost ratios, and individual equity guarantees the ordinal placement of net present values. For example, relative valuations for covered workers contributing a constant 80% of the maximum level of contributions are not explicitly calculated. However, by implication the relative valuations fall ordinally between those for the maximum and the 75% of maximum contributors. Typically, two

contribution levels are chosen for research of this type; four were chosen in this research for thoroughness.

Table 1 through Table 4 contain benefit-cost ratios and net present values derived from contributions valuated using Treasury bill yields and from benefit streams valuated using risk-free rates forecasted as the historical average real yield on one-month Treasury bills. In Table 1 and Table 2 all benefit-cost ratios are greater than unity. Clearly, all covered workers who choose the Treasury bill alternative make an inferior choice.⁸⁸

The inferiority of choosing the Treasury bill alternative is also revealed by examining Table 3 and Table 4. The net present values are positive for all covered workers irrespective of gender or year of retirement.⁸⁹

Important observations can be made by examining Table 1 through Table 4. Without exception, retired female

⁸⁸As previously discussed, deductions can be drawn about benefit-cost ratios of retired workers whose contribution paths fall between the paths examined because of the incorporation of the social adequacy principle into the social security benefit structure. Hypothetically, this incorporation guarantees that benefit-cost ratios increase (for comparable cases) as the level of contributions decrease. In Table 1 and Table 2 each retiree who is a maximum contributor has a benefit-cost ratio that exceeds unity; therefore, by implication every retired worker's benefit-cost ratio also exceeds unity.

⁸⁹From footnote 88 we know that the net present value of each member of the universe of covered workers is greater than zero because all benefit-cost ratios are greater than unity.

Table 1. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	32.98	37.10	45.34	70.06
1941	25.44	28.62	34.98	54.07
1942	20.62	22.54	28.35	43.70
1943	17.13	19.27	23.55	36.39
1944	15.24	17.14	20.95	32.38
1945	13.57	15.26	18.66	28.83
1946	12.37	13.91	17.00	26.28
1947	11.01	12.39	15.14	23.40
1948	10.00	11.25	13.75	21.24
1949	9.39	10.56	12.91	19.95
1950	8.69	9.77	11.94	18.46
1951	12.11	14.69	19.31	30.89
1952	10.40	12.77	16.97	27.38
1953	11.50	14.43	16.90	22.34
1954	10.51	13.19	15.46	20.43
1955	10.58	12.18	14.99	18.08
1956	9.98	11.20	13.67	17.20
1957	9.14	10.21	12.38	16.14
1958	8.12	9.07	11.00	14.34
1959	8.03	8.96	10.94	14.13
1960	7.25	8.04	9.75	12.92
1961	6.54	7.27	8.83	11.78
1962	5.86	6.52	7.85	10.65
1963	5.23	5.83	7.03	9.42
1964	4.78	5.29	6.38	8.71
1965	4.56	5.10	6.09	8.32
1966	4.11	4.56	5.44	7.44
1967	3.73	4.12	4.94	6.95
1968	3.30	3.65	4.36	6.25
1969	3.96	4.38	5.19	7.54
1970	3.58	3.96	4.67	6.83
1971	3.55	3.91	4.59	6.73
1972	3.23	3.57	4.16	6.04
1973	3.60	3.95	4.63	6.68
1974	3.28	3.60	4.22	5.98
1975	3.30	3.63	4.21	5.96
1976	3.35	3.64	4.22	5.85
1977	3.41	3.67	4.23	5.83
1978	3.39	3.68	4.21	5.72
1979	3.30	3.60	4.12	5.55
1980	3.11	3.49	3.96	5.26
1981	3.15	3.63	4.08	5.34
1982	2.60	2.90	3.27	4.39
1983	2.33	2.67	3.00	4.00
1984	2.01	2.31	2.60	3.46
1985	1.78	2.05	2.30	3.05

Table 2. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	37.07	41.70	50.96	78.74
1941	28.82	32.42	39.62	61.23
1942	23.34	25.51	32.08	49.46
1943	19.37	21.78	26.63	41.15
1944	17.20	19.35	23.65	36.54
1945	15.42	17.34	21.20	32.76
1946	14.00	15.75	19.25	29.75
1947	12.62	14.20	17.36	26.82
1948	11.55	13.00	15.88	24.54
1949	10.91	12.27	15.00	23.18
1950	10.19	11.47	14.01	21.66
1951	14.24	17.28	22.72	36.35
1952	12.24	15.03	19.97	32.23
1953	13.61	17.08	20.01	26.45
1954	12.48	15.67	18.36	24.26
1955	12.61	14.52	17.87	21.55
1956	11.96	13.42	16.39	20.62
1957	11.03	12.32	14.94	19.47
1958	9.82	10.97	13.30	17.34
1959	9.73	10.85	13.26	17.12
1960	8.89	9.86	11.96	15.84
1961	8.03	8.92	10.84	14.45
1962	7.36	8.14	9.81	13.40
1963	6.69	7.35	8.88	12.20
1964	6.17	6.80	8.16	11.46
1965	5.93	6.54	7.85	11.04
1966	5.33	5.87	7.05	9.91
1967	4.88	5.37	6.42	9.11
1968	4.42	4.89	5.75	8.47
1969	5.34	5.87	6.95	10.05
1970	4.80	5.30	6.27	8.98
1971	4.77	5.25	6.16	8.88
1972	4.38	4.82	5.68	8.13
1973	4.90	5.38	6.26	9.01
1974	4.44	4.89	5.67	8.02
1975	4.55	4.95	5.74	8.02
1976	4.56	4.89	5.68	7.86
1977	4.58	4.88	5.65	7.74
1978	4.43	4.80	5.51	7.48
1979	4.30	4.70	5.38	7.24
1980	4.05	4.54	5.15	6.85
1981	4.09	4.72	5.30	6.93
1982	3.38	3.77	4.26	5.71
1983	3.04	3.47	3.91	5.21
1984	2.62	3.01	3.38	4.51
1985	2.32	2.67	3.00	3.98

Table 3. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5698.29	4824.28	3950.27	3076.26
1941	5751.51	4874.89	3998.28	3121.67
1942	5270.34	4339.16	3673.06	2867.17
1943	4770.86	4052.55	3335.44	2617.12
1944	4776.87	4061.63	3346.40	2631.16
1945	4728.06	4024.57	3321.08	2617.59
1946	4715.46	4016.68	3319.06	2621.45
1947	3917.72	3341.76	2766.79	2190.83
1948	3568.55	3047.92	2527.28	2006.65
1949	3554.07	3038.46	2522.86	2007.25
1950	3624.25	3101.48	2579.61	2057.74
1951	5566.39	5144.69	4588.33	3745.84
1952	5048.30	4742.30	4289.52	3543.20
1953	6270.65	6016.01	4751.36	3187.73
1954	6279.99	6036.83	4773.02	3207.10
1955	7127.08	6238.63	5203.66	3175.67
1956	7542.42	6424.17	5322.12	3402.10
1957	7501.32	6365.41	5245.04	3488.09
1958	7157.32	6084.58	5026.89	3352.29
1959	7620.61	6465.82	5386.08	3555.96
1960	7513.10	6348.88	5257.90	3581.03
1961	7423.73	6298.05	5245.41	3608.56
1962	7197.94	6133.66	5069.37	3574.73
1963	6888.87	5899.83	4910.78	3432.96
1964	6812.32	5791.91	4841.53	3471.03
1965	7079.36	6102.85	5050.61	3633.55
1966	6751.11	5787.51	4817.20	3490.67
1967	6547.12	5599.56	4717.80	3559.69
1968	6023.67	5206.38	4389.09	3434.08
1969	8397.26	7183.20	5944.81	4633.40
1970	7907.27	6800.58	5630.28	4471.56
1971	8402.15	7189.78	5922.49	4726.59
1972	7900.52	6827.36	5611.15	4469.11
1973	9898.56	8408.70	6903.39	5398.09
1974	9181.03	7859.71	6480.67	5010.25
1975	9634.70	8278.67	6739.00	5203.71
1976	10496.48	8846.32	7187.95	5414.51
1977	11534.97	9575.20	7714.26	5766.35
1978	12041.74	10102.71	8089.40	5946.12
1979	12094.49	10286.70	8227.12	5991.64
1980	11642.31	10266.74	8138.66	5869.67
1981	12581.44	11535.87	9004.25	6336.55
1982	10552.75	9381.31	7485.65	5579.90
1983	9929.45	9305.31	7456.64	5593.28
1984	8365.01	8138.58	6617.66	5094.37
1985	7207.56	7312.68	6058.28	4762.48

Table 4. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	6425.94	5438.19	4450.44	3462.69
1941	6544.99	5544.39	4543.80	3543.20
1942	6000.01	4937.32	4174.62	3253.72
1943	5433.45	4611.53	3790.96	2969.04
1944	5433.88	4615.95	3798.02	2980.08
1945	5423.18	4611.08	3798.97	2986.87
1946	5393.61	4588.74	3785.21	2981.68
1947	4547.51	3873.08	3199.77	2525.34
1948	4184.60	3567.67	2950.74	2333.82
1949	4197.10	3581.02	2964.94	2348.86
1950	4333.86	3700.09	3067.38	2434.68
1951	6638.29	6119.95	5443.17	4429.72
1952	6037.65	5653.65	5096.89	4194.58
1953	7532.60	7203.73	5679.26	3800.89
1954	7583.30	7263.46	5731.33	3840.36
1955	8638.88	7544.06	6274.58	3821.35
1956	9207.74	7825.62	6462.91	4119.72
1957	9239.24	7821.42	6422.34	4255.34
1958	8867.15	7517.06	6185.16	4107.13
1959	9464.55	8007.74	6641.86	4366.66
1960	9486.74	7990.82	6584.72	4460.04
1961	9414.77	7957.26	6589.37	4504.53
1962	9416.22	7925.97	6524.32	4591.09
1963	9274.13	7762.50	6425.33	4564.76
1964	9299.18	7826.48	6441.17	4706.29
1965	9796.55	8255.61	6801.38	4983.00
1966	9375.89	7921.67	6552.39	4826.37
1967	9294.69	7856.06	6492.59	4853.57
1968	8941.85	7639.87	6216.65	4882.34
1969	12290.12	10341.70	8432.58	6413.41
1970	11649.70	9898.65	8072.68	6119.33
1971	12423.68	10523.36	8516.04	6501.58
1972	11999.66	10160.47	8300.53	6322.96
1973	14825.02	12500.40	10000.54	7615.26
1974	13836.13	11739.17	9397.70	7068.76
1975	14897.72	12439.18	9940.60	7367.63
1976	15901.49	13033.55	10445.16	7652.48
1977	17119.96	13907.93	11110.64	8054.14
1978	17286.27	14365.17	11346.99	8158.90
1979	17398.93	14636.47	11545.30	8224.48
1980	16803.72	14599.80	11416.88	8050.64
1981	18085.73	16291.35	12567.00	8665.91
1982	15714.20	13694.05	10731.60	7756.02
1983	15171.41	13797.36	10829.38	7842.26
1984	13412.27	12489.29	9879.44	7266.50
1985	12217.65	11649.36	9308.70	6914.05

workers enjoy greater benefit-cost ratios and net present values than their male counterparts. These findings support the work of Pechman, et al.,⁹⁰ Myers and Schobel,⁹¹ and Parsons and Munro.⁹² The significance of this observation is that the social security benefit structure discriminates between two retirees who are alike in every respect (that is, born on the same date and follow the same contribution path) except gender. There are at least two reasons for this empirically manifested discrimination. First, Table A-23 and Table A-24 in the Appendix for years 1962-1977, show that nominal benefits for retired female workers are higher than those for their male counterparts. This unequal treatment was remedied in 1978 when nominal benefits for each gender were equalized. However, unequal nominal benefits only partially explain observed differences in benefit-cost ratios and net present values. Differences in life expectancies after attainment of age 65 provide the balance of the explanation. The life expectancy of female retirees is greater than that of their male counterparts. If social security desired to implement a more egalitarian benefit structure, a major issue that

⁹⁰Pechman, et al., pp. 237-246.

⁹¹Myers and Schobel, pp. 39, 41.

⁹²Parsons and Munro, 75-78.

would have to be addressed is unequal life expectancies of genders.⁹³

An examination of Table 1 and Table 2 reveals absolute increases in benefit-cost ratios as the level of historical contributions declines. This observation is significant because it supports the realization of the hypothetical benefits of the incorporation of the social adequacy principle into the social security benefit structure. This finding also supports the research of Campbell and Campbell,⁹⁴ Chen and Chu,⁹⁵ Pechman, et al.,⁹⁶ and Myers and Schobel⁹⁷.

A significant finding is revealed by examining data in Table 3 and Table 4. Supposedly, the incorporation of the individual equity principle into the social security benefit structure guarantees that the historically highest income earner will have the largest net present value. The realization of this guarantee is supported absolutely in Table 4 (retired female workers). However, its realization

⁹³Adjustments of benefits for men and women because of variances in life expectancies may not be an option available to social security. Adjustments of this nature are not available in the private sector; there remains a question as to whether it is available in the public sector.

⁹⁴Campbell and Campbell, p. 74.

⁹⁵Chen and Chu, pp. 196, 201.

⁹⁶Pechman, et al., pp. 237-246.

⁹⁷Myers and Schobel, pp. 39, 41.

is supported in Table 3 (retired male workers) only through the 1984 year of retirement. In 1985 there is an increase in net present values between the maximum case retired male worker and the 75% of maximum case retired male worker.⁹⁸ In the "anomalous" year, support for the ordinal placement of net present values implied by the incorporation of the individual equity principle into the social security benefit structure is found for contribution paths below the 75% of maximum level. The most curious aspect of the observed lack of absolute support is that social security has not publicized departure from strict adherence to the individual equity principle, at least in the visible public record. The departure may be an inadvertent occurrence brought about when social security revised benefit formulas to amend the mistake that doubly adjusted for inflation. The sacrificing of individual equity in extreme cases may have accidentally been incorporated into the adjusted formulas. As is demonstrated later, variations in valuations of contribution streams result in more anomalous

⁹⁸This finding raises a question about the safety of assuming the ordinal placement of net present values implied by the individual equity principle. Some researchers derive net present values for only two levels of contributions; for example, for the maximum and 50% of maximum levels. Subsequently, they assume information about the net present values associated with those levels not explicitly examined. (See Ozawa, p. 9.) Had only two levels of contributions, such as the maximum and 50% of maximum levels, been examined in this research, then the "aberration" in the ordinal placement of net present values would not have manifested in Table 3.

years like the one observed in Table 3. Aside from the observed departure from strict adherence to the individual equity principle, other results in Table 3 and Table 4 generally support those of Campbell and Campbell,⁹⁹ Ozawa,¹⁰⁰ and Parsons and Munro.¹⁰¹

Another proposition discussed in Chapter III pertains to the relative treatment by the social security benefit structure of earlier retired covered workers vis-a-vis that of later counterparts. Though the results are not absolute, the proposition that earlier retired covered workers have been treated more favorably is generally supported by results contained in Table 1 through Table 4. This finding supports the research of Campbell and Campbell,¹⁰² Chen and Chu,¹⁰³ and Myers and Schobel.¹⁰⁴

The results in Table 3 and Table 4 reveal implementations of revisions in benefit formulas. For example, the first major revision occurs for benefits paid in 1951.¹⁰⁵ Clearly, there is a dramatic increase in net

⁹⁹Campbell and Campbell, p. 74.

¹⁰⁰Ozawa, p. 9.

¹⁰¹Parsons and Munro, pp. 75-78.

¹⁰²Campbell and Campbell, pp. 74, 77.

¹⁰³Chen and Chu, pp. 201-205.

¹⁰⁴Myers and Schobel, pp. 39, 41.

¹⁰⁵U. S. Department of Health and Human Services, Social Security Administration, Social Security Bulletin:

present values in both tables from 1950 to 1951. The next major increase, that in 1973, results from double adjustment for inflation in the benefit formulas. The last major revision, that in 1982, causes the expected benefits of retirees born in 1917, the first "notch babies," to decline. This revision incorporates a downward adjustment of benefits to remove excess payments created by the technical error that doubly adjusted for inflation (caused by the 1972 social security amendments).

A brief summary of the findings in Table 1 through Table 4 is in order. First, investment in Treasury bills is inferior to investment in social security. Second, the social security benefit plan has been structured to insure the realization of the hypothesized benefits of the social adequacy principle. However, the more recent history of the plan does not insure the realization of the hypothesized benefits of the individual equity principle. Third, the plan favors retired female workers over their male counterparts. And finally, earlier retired covered workers generally have higher expected returns from investment in social security than comparable later ones.

The next set of tables, Table 5 through Table 8, is derived assuming covered workers choose the Treasury bill alternative and real risk-free rates are forecasted by the

Table 5. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	28.10	31.61	38.63	59.69
1941	21.61	24.31	29.71	45.92
1942	17.46	19.09	24.01	37.01
1943	14.56	16.37	20.02	30.93
1944	12.89	14.50	17.73	27.39
1945	11.45	12.89	15.75	24.34
1946	10.41	11.71	14.31	22.12
1947	9.30	10.46	12.78	19.75
1948	8.43	9.49	11.59	17.92
1949	7.91	8.90	10.87	16.80
1950	7.32	8.23	10.06	15.55
1951	10.19	12.37	16.26	26.01
1952	8.74	10.73	14.26	23.01
1953	9.67	12.13	14.22	18.79
1954	8.81	11.05	12.95	17.12
1955	8.88	10.23	12.58	15.17
1956	8.38	9.41	11.48	14.45
1957	7.69	8.59	10.42	13.58
1958	6.83	7.63	9.25	12.06
1959	6.74	7.52	9.19	11.86
1960	6.10	6.77	8.20	10.87
1961	5.49	6.10	7.41	9.89
1962	4.93	5.49	6.60	8.96
1963	4.41	4.91	5.92	7.94
1964	4.02	4.45	5.36	7.32
1965	3.84	4.29	5.12	7.00
1966	3.46	3.84	4.58	6.26
1967	3.14	3.46	4.15	5.84
1968	2.78	3.08	3.67	5.27
1969	3.33	3.68	4.36	6.33
1970	3.00	3.32	3.92	5.73
1971	2.98	3.28	3.85	5.65
1972	2.71	2.99	3.49	5.07
1973	3.02	3.31	3.88	5.60
1974	2.74	3.01	3.52	4.99
1975	2.75	3.02	3.51	4.96
1976	2.79	3.03	3.51	4.87
1977	2.84	3.05	3.51	4.84
1978	2.82	3.05	3.50	4.75
1979	2.73	2.98	3.41	4.59
1980	2.58	2.89	3.28	4.36
1981	2.61	3.00	3.38	4.41
1982	2.15	2.39	2.70	3.62
1983	1.93	2.20	2.48	3.30
1984	1.66	1.90	2.14	2.85
1985	1.46	1.69	1.90	2.51

Table 6. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	30.98	34.85	42.59	65.81
1941	23.96	26.96	32.95	50.92
1942	19.35	21.15	26.60	41.00
1943	16.12	18.14	22.17	34.26
1944	14.25	16.03	19.59	30.27
1945	12.73	14.32	17.50	27.04
1946	11.53	12.97	15.85	24.50
1947	10.40	11.70	14.30	22.10
1948	9.50	10.68	13.06	20.18
1949	8.94	10.06	12.30	19.00
1950	8.34	9.38	11.47	17.73
1951	11.65	14.13	18.58	29.72
1952	9.98	12.26	16.30	26.29
1953	11.10	13.93	16.32	21.57
1954	10.13	12.71	14.90	19.69
1955	10.25	11.80	14.52	17.51
1956	9.72	10.90	13.31	16.75
1957	8.96	10.01	12.14	15.83
1958	7.97	8.91	10.80	14.08
1959	7.89	8.79	10.74	13.87
1960	7.20	7.99	9.68	12.83
1961	6.49	7.21	8.76	11.67
1962	5.95	6.58	7.93	10.83
1963	5.41	5.95	7.19	9.87
1964	4.97	5.48	6.57	9.23
1965	4.78	5.27	6.32	8.89
1966	4.29	4.73	5.68	7.98
1967	3.92	4.32	5.16	7.31
1968	3.55	3.93	4.62	6.80
1969	4.27	4.69	5.56	8.04
1970	3.83	4.23	5.00	7.17
1971	3.80	4.19	4.91	7.08
1972	3.49	3.84	4.53	6.48
1973	3.90	4.28	4.98	7.16
1974	3.51	3.87	4.49	6.36
1975	3.59	3.91	4.53	6.33
1976	3.60	3.86	4.48	6.19
1977	3.60	3.83	4.44	6.08
1978	3.48	3.77	4.33	5.88
1979	3.37	3.68	4.21	5.67
1980	3.18	3.56	4.04	5.38
1981	3.21	3.69	4.15	5.43
1982	2.65	2.95	3.33	4.46
1983	2.37	2.71	3.05	4.07
1984	2.04	2.34	2.64	3.51
1985	1.80	2.08	2.34	3.09

Table 7. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	4828.68	4090.60	3352.52	2614.44
1941	4849.16	4113.54	3377.91	2642.29
1942	4422.19	3643.88	3090.06	2417.85
1943	4010.52	3411.11	2812.70	2213.28
1944	3989.60	3397.42	2805.24	2213.06
1945	3933.16	3353.87	2774.59	2195.30
1946	3903.75	3331.93	2761.10	2190.27
1947	3246.21	2775.25	2305.12	1834.17
1948	2947.62	2524.04	2100.46	1676.88
1949	2926.42	2508.89	2091.35	1673.82
1950	2978.44	2556.68	2135.69	1714.69
1951	4607.68	4272.40	3823.75	3134.18
1952	4157.91	3922.10	3562.91	2956.97
1953	5178.78	4988.37	3948.51	2657.21
1954	5154.99	4978.00	3945.81	2660.48
1955	5863.07	5147.16	4308.26	2635.82
1956	6199.90	5294.38	4402.47	2823.59
1957	6165.91	5246.63	4340.41	2898.54
1958	5859.63	4997.39	4147.81	2779.39
1959	6224.64	5298.51	4435.37	2942.22
1960	6129.47	5197.80	4327.73	2964.79
1961	6016.43	5125.31	4295.49	2975.27
1962	5818.18	4981.96	4145.73	2947.57
1963	5551.15	4781.40	4011.66	2829.88
1964	5436.67	4651.14	3924.43	2844.73
1965	5639.12	4896.63	4090.45	2977.41
1966	5339.98	4614.59	3883.53	2852.63
1967	5117.88	4417.47	3772.33	2895.02
1968	4662.37	4076.90	3491.42	2789.93
1969	6600.81	5694.27	4767.29	3778.97
1970	6137.95	5333.29	4475.29	3626.98
1971	6516.73	5632.60	4702.41	3832.10
1972	6060.71	5302.55	4424.34	3608.38
1973	7681.93	6586.92	5478.96	4370.99
1974	7003.48	6065.97	5080.25	4018.22
1975	7322.05	6368.16	5261.34	4158.16
1976	7987.09	6800.90	5607.86	4319.07
1977	8770.67	7345.41	6002.23	4586.82
1978	9141.05	7745.19	6287.67	4722.25
1979	9102.78	7833.43	6355.67	4732.32
1980	8712.83	7807.42	6278.04	4631.82
1981	9394.98	8782.90	6941.76	4988.07
1982	7573.93	6892.31	5612.32	4323.99
1983	6891.66	6702.11	5502.10	4289.97
1984	5438.31	5615.77	4726.28	3834.84
1985	4290.41	4787.63	4165.71	3509.71

Table 8. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bill Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5341.30	4523.09	3704.88	2886.67
1941	5403.25	4581.06	3758.86	2936.66
1942	4928.51	4058.94	3438.09	2686.08
1943	4474.17	3802.25	3131.46	2459.54
1944	4444.68	3781.37	3118.06	2454.74
1945	4411.74	3757.67	3103.61	2449.54
1946	4367.81	3723.41	3080.09	2436.78
1947	3678.92	3140.30	2602.61	2064.00
1948	3369.33	2879.83	2390.34	1900.84
1949	3364.67	2878.66	2392.64	1906.63
1950	3461.20	2963.93	2467.53	1971.13
1951	5335.82	4934.90	4404.44	3598.74
1952	4827.30	4538.72	4109.17	3397.69
1953	6032.61	5791.98	4576.33	3072.07
1954	6028.48	5800.11	4588.09	3084.90
1955	6879.80	6025.10	5028.49	3070.06
1956	7319.90	6236.91	5169.69	3306.21
1957	7338.46	6228.98	5134.71	3416.20
1958	7011.18	5962.14	4927.89	3287.77
1959	7461.06	6332.41	5277.42	3485.81
1960	7455.46	6300.93	5219.15	3555.35
1961	7346.96	6234.08	5193.59	3574.01
1962	7329.76	6195.74	5133.35	3641.16
1963	7190.82	6045.85	5042.01	3614.77
1964	7144.77	6045.27	5016.21	3705.42
1965	7503.46	6359.04	5284.46	3916.60
1966	7131.71	6065.56	5067.84	3782.72
1967	6991.44	5954.24	4977.38	3779.27
1968	6662.28	5746.07	4732.54	3790.38
1969	9261.40	7845.05	6460.13	4987.20
1970	8671.88	7430.28	6128.91	4725.94
1971	9237.39	7889.33	6455.94	5016.86
1972	8842.61	7556.99	6254.84	4858.94
1973	11010.93	9356.95	7563.61	5861.39
1974	10124.06	8672.06	7026.35	5390.58
1975	10862.19	9144.97	7396.17	5588.70
1976	11585.33	9561.70	7758.38	5794.06
1977	12422.85	10156.02	8214.98	6070.32
1978	12500.86	10475.86	8374.58	6139.83
1979	12477.23	10600.56	8466.55	6152.75
1980	12013.87	10578.68	8374.66	6026.68
1981	12894.55	11806.38	9206.92	6469.05
1982	10845.65	9626.05	7669.85	5703.39
1983	10203.49	9540.15	7632.97	5710.86
1984	8617.09	8355.87	6780.56	5202.85
1985	7435.40	7509.90	6206.10	4860.32

historical average growth rate of real GNP. The results observed in these tables are similar to those observed in the first four tables. All benefit-cost ratios exceed unity, and all net present values are greater than zero, findings which support the desirability of investing in social security. Earlier retired covered workers generally are treated better by the social security benefit plan than comparable later ones. Female covered workers fare better by investing in social security than do their male counterparts. The benefits implied by the incorporation of the social adequacy principle into the social security benefit plan are observed without exception in Table 5 and Table 6. That is, as historical earnings decline, benefit-cost ratios increase. However, as valuations of benefit streams decline¹⁰⁶ relative to valuations of contribution streams¹⁰⁷ more anomalous years such as the one found in Table 3 (see p. 57, 1985) are found in the net present value results (Table 7 and Table 8). These are observed for years 1984 and 1985 in Table 7 and for 1985 in Table 8. (Further discussion about these anomalous years occurs later in the chapter.) The results in Table 7 and Table 8

¹⁰⁶The decline occurs because the rates of discount increase. See Tables A-28 and A-29 in the Appendix.

¹⁰⁷Note that valuations of contribution streams do not change from those in the first set of tables, only valuations of benefit streams change.

generally support the research of Ozawa,¹⁰⁸ as well as others. A direct reference is made to the Ozawa study since she calculates net present values which utilize benefit streams valuated at rates equal to the average historical growth rate of real GNP, the same rates used to valuate benefit streams which were used to calculate net present values found in Table 7 and Table 8.

Table 9 through Table 12 are derived under the assumption that covered workers choose the Treasury bond alternative and that benefit streams are valuated using discount rates equal to the historical average of real yields on one-month Treasury bills. The results clearly demonstrate the desirability of investing in social security vis-a-vis investing in Treasury bonds. All benefit-cost ratios are greater than unity, and all net present values are positive. Additionally, the results support absolutely the realization of the hypothesized benefits of the incorporation of the social adequacy and individual equity principles into the social security benefit plan, favorable treatment by the benefit plan of retired female workers over their male counterparts, and the generally favorable treatment by the benefit plan of earlier retirees over comparable later retirees. An interesting observation is made by comparing the results in

¹⁰⁸Ozawa, p. 9.

Table 9. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	30.43	34.23	41.83	64.63
1941	22.71	25.55	31.23	48.26
1942	18.67	20.41	25.67	39.57
1943	15.36	17.28	21.12	32.64
1944	13.66	15.37	18.78	29.02
1945	12.04	13.55	16.56	25.59
1946	10.13	11.39	13.92	21.52
1947	9.22	10.37	12.68	19.59
1948	8.77	9.86	12.05	18.63
1949	8.12	9.13	11.16	17.25
1950	7.23	8.13	9.93	15.35
1951	10.35	12.56	16.51	26.42
1952	9.51	11.68	15.51	25.03
1953	10.65	13.37	15.67	20.70
1954	9.62	12.08	14.15	18.70
1955	9.24	10.64	13.09	15.78
1956	9.06	10.17	12.41	15.62
1957	9.05	10.11	12.27	15.99
1958	7.73	8.63	10.47	13.65
1959	8.27	9.23	11.27	14.55
1960	7.83	8.69	10.53	13.95
1961	6.37	7.08	8.61	11.47
1962	5.97	6.65	8.00	10.86
1963	5.13	5.71	6.89	9.24
1964	4.78	5.29	6.38	8.71
1965	4.56	5.10	6.08	8.32
1966	4.24	4.70	5.61	7.67
1967	3.87	4.27	5.12	7.20
1968	3.90	4.31	5.14	7.37
1969	4.87	5.38	6.38	9.26
1970	4.83	5.34	6.30	9.22
1971	4.45	4.91	5.77	8.45
1972	3.69	4.08	4.77	6.91
1973	4.02	4.40	5.16	7.45
1974	3.91	4.29	5.02	7.12
1975	3.98	4.38	5.08	7.19
1976	3.86	4.20	4.86	6.75
1977	3.52	3.78	4.36	6.00
1978	3.68	3.99	4.57	6.21
1979	3.85	4.21	4.81	6.48
1980	4.01	4.48	5.09	6.77
1981	4.56	5.25	5.90	7.72
1982	4.07	4.53	5.12	6.86
1983	2.80	3.20	3.61	4.81
1984	2.57	2.96	3.32	4.43
1985	2.12	2.45	2.76	3.65

Table 10. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	34.19	38.47	47.01	72.64
1941	25.72	28.94	35.37	54.66
1942	21.13	23.10	29.05	44.78
1943	17.37	19.54	23.89	36.91
1944	15.42	17.34	21.20	32.75
1945	13.68	15.39	18.81	29.08
1946	11.47	12.90	15.76	24.36
1947	10.57	11.89	14.53	22.46
1948	10.13	11.40	13.93	21.52
1949	9.43	10.61	12.97	20.04
1950	8.48	9.54	11.65	18.01
1951	12.18	14.78	19.43	31.09
1952	11.19	13.74	18.26	29.47
1953	12.61	15.82	18.54	24.51
1954	11.43	14.34	16.81	22.22
1955	11.01	12.68	15.60	18.81
1956	10.86	12.19	14.88	18.72
1957	10.92	12.20	14.80	19.29
1958	9.35	10.44	12.66	16.50
1959	10.03	11.18	13.66	17.63
1960	9.61	10.65	12.91	17.11
1961	7.82	8.69	10.56	14.08
1962	7.50	8.29	10.00	13.66
1963	6.56	7.21	8.71	11.97
1964	6.17	6.80	8.16	11.46
1965	5.93	6.54	7.85	11.03
1966	5.49	6.06	7.27	10.21
1967	5.06	5.57	6.66	9.44
1968	5.21	5.77	6.79	9.99
1969	6.56	7.21	8.54	12.35
1970	6.47	7.15	8.45	12.11
1971	5.99	6.60	7.74	11.16
1972	5.02	5.52	6.50	9.31
1973	5.46	6.00	6.98	10.05
1974	5.28	5.82	6.75	9.55
1975	5.49	5.98	6.92	9.68
1976	5.26	5.64	6.55	9.06
1977	4.72	5.03	5.82	7.98
1978	4.81	5.22	5.98	8.12
1979	5.02	5.49	6.28	8.46
1980	5.21	5.83	6.62	8.81
1981	5.92	6.82	7.67	10.03
1982	5.29	5.90	6.66	8.93
1983	3.65	4.17	4.70	6.27
1984	3.35	3.85	4.33	5.77
1985	2.77	3.20	3.59	4.76

Table 11. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5683.33	4813.06	3942.79	3072.52
1941	5723.20	4853.66	3984.13	3114.59
1942	5242.30	4318.14	3659.04	2860.16
1943	4736.88	4027.07	3318.45	2608.63
1944	4738.10	4032.56	3327.01	2621.47
1945	4680.42	3988.84	3297.26	2605.68
1946	4623.70	3947.86	3273.18	2598.51
1947	3841.70	3284.75	2728.77	2171.82
1948	3512.85	3006.14	2499.43	1992.72
1949	3487.72	2988.70	2489.68	1990.66
1950	3528.85	3029.93	2531.91	2033.89
1951	5481.56	5081.06	4545.91	3724.64
1952	4997.99	4704.57	4264.37	3530.62
1953	6223.43	5980.59	4727.74	3175.93
1954	6219.17	5991.21	4742.61	3191.90
1955	7018.97	6157.54	5149.61	3148.64
1956	7457.07	6360.16	5279.45	3380.76
1957	7492.48	6358.78	5240.62	3485.88
1958	7106.37	6046.37	5001.41	3339.55
1959	7652.31	6489.60	5401.93	3563.89
1960	7602.33	6415.80	5302.51	3603.33
1961	7388.51	6271.64	5227.80	3599.75
1962	7226.31	6154.93	5083.56	3581.82
1963	6856.91	5875.85	4894.80	3424.97
1964	6811.99	5791.67	4841.36	3470.95
1965	7079.03	6102.59	5050.44	3633.47
1966	6816.54	5836.59	4849.91	3507.03
1967	6632.16	5663.34	4760.31	3580.94
1968	6421.71	5504.91	4588.11	3533.59
1969	8924.43	7578.58	6208.39	4765.19
1970	8699.67	7394.88	6026.48	4669.65
1971	9074.37	7693.94	6258.60	4894.64
1972	8350.30	7164.69	5836.04	4581.56
1973	10291.45	8703.36	7099.84	5496.31
1974	9825.14	8342.79	6802.72	5171.27
1975	10352.28	8816.86	7097.80	5383.10
1976	11086.45	9288.80	7482.94	5562.01
1977	11676.44	9681.31	7784.99	5801.72
1978	12438.17	10400.03	8287.62	6045.23
1979	12849.91	10853.27	8604.84	6180.50
1980	12868.07	11186.07	8751.55	6176.11
1981	14385.82	12889.15	9906.44	6787.64
1982	12927.62	11162.47	8673.09	6173.62
1983	11181.17	10244.11	8082.51	5906.21
1984	10176.73	9497.37	7523.52	5547.30
1985	8733.33	8457.01	6821.17	5143.92

Table 12. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	6410.98	5426.97	4442.96	3458.95
1941	6516.68	5523.16	4529.64	3536.13
1942	5971.97	4916.29	4160.60	3246.71
1943	5399.47	4586.05	3773.97	2960.55
1944	5395.12	4586.88	3778.63	2970.39
1945	5375.53	4575.34	3775.15	2974.96
1946	5301.85	4519.92	3739.33	2958.74
1947	4471.49	3816.06	3161.76	2506.33
1948	4128.90	3525.90	2922.89	2319.89
1949	4130.75	3531.26	2931.77	2332.27
1950	4238.45	3628.54	3019.68	2410.83
1951	6553.45	6056.32	5400.75	4408.51
1952	5987.35	5615.93	5071.74	4182.00
1953	7485.37	7168.31	5655.64	3789.08
1954	7522.47	7217.84	5700.92	3825.15
1955	8530.76	7462.97	6220.53	3794.32
1956	9122.39	7761.61	6420.24	4098.38
1957	9230.40	7814.79	6417.92	4253.13
1958	8816.20	7478.84	6159.68	4094.40
1959	9496.24	8031.51	6657.71	4374.58
1960	9575.97	8057.74	6629.33	4482.35
1961	9379.55	7930.85	6571.76	4495.72
1962	9444.59	7947.25	6538.50	4598.19
1963	9242.16	7738.52	6409.34	4556.77
1964	9298.85	7826.23	6441.01	4706.21
1965	9796.21	8255.36	6801.21	4982.91
1966	9441.32	7970.74	6585.11	4842.73
1967	9379.72	7919.84	6535.10	4874.83
1968	9339.89	7938.40	6415.67	4981.85
1969	12817.30	10737.08	8696.17	6545.21
1970	12442.10	10492.95	8468.88	6317.43
1971	13095.90	11027.53	8852.15	6669.63
1972	12449.44	10497.81	8525.42	6435.40
1973	15217.91	12795.06	10196.98	7713.48
1974	14480.23	12222.25	9719.75	7229.79
1975	15615.31	12977.37	10299.39	7547.02
1976	16491.47	13476.03	10740.14	7799.97
1977	17261.43	14014.04	11181.38	8089.51
1978	17682.69	14662.49	11545.20	8258.01
1979	18154.35	15203.04	11923.01	8413.33
1980	18029.49	15519.13	12029.76	8357.08
1981	19890.11	17644.63	13469.19	9117.01
1982	18089.08	15475.21	11919.04	8349.74
1983	16423.14	14736.16	11455.24	8155.20
1984	15223.99	13848.08	10785.30	7719.43
1985	13743.43	12793.69	10071.58	7295.49

Table 9 through Table 12 with those in Table 1 through Table 4 (see pp. 55-58). In general, the valuations of contributions using Treasury bond rates are less than those using Treasury bill rates. Opposite results might be expected since Treasury bonds should possess maturity premiums that Treasury bills do not. Therefore, on average, ex post returns from investment in Treasury bonds should exceed ex post returns from investment in Treasury bills; this was not the finding. Since Treasury bills are short-term and Treasury bonds are long-term, the returns on Treasury bonds are exposed to more price risk and unanticipated inflation than returns on Treasury bills. Obviously, the usage of Treasury bills as the surrogate for the risk-free asset is a better choice than using Treasury bonds as the surrogate.

Results in Table 13 through Table 16 are also derived assuming that the chosen alternative is Treasury bonds, but that risk-free rates are forecasted by the average historical growth rate of real GNP. Conclusions drawn from these results are similar to those drawn from the results contained in Table 9 through Table 12 with one exception; the realization of the hypothesized benefits of the incorporation of the individual equity principle into the social security benefit plan is not observed without exception. The exception is observed in Table 15 when comparing 1985 maximum male retirees to 1985 75% of maximum

Table 13. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	25.92	29.16	35.64	55.07
1941	19.29	21.70	26.52	40.99
1942	15.81	17.28	21.74	33.51
1943	13.06	14.69	17.95	27.74
1944	11.56	13.00	15.89	24.55
1945	10.17	11.44	13.98	21.61
1946	8.53	9.59	11.72	18.11
1947	7.78	8.76	10.70	16.54
1948	7.39	8.32	10.17	15.71
1949	6.84	7.69	9.40	14.53
1950	6.09	6.85	8.37	12.93
1951	8.72	10.58	13.90	22.25
1952	7.99	9.81	13.04	21.04
1953	8.96	11.24	13.18	17.41
1954	8.06	10.12	11.86	15.67
1955	7.75	8.93	10.99	13.25
1956	7.61	8.54	10.42	13.12
1957	7.62	8.51	10.32	13.45
1958	6.50	7.26	8.80	11.48
1959	6.95	7.75	9.46	12.22
1960	6.59	7.31	8.86	11.74
1961	5.35	5.95	7.22	9.63
1962	5.02	5.59	6.73	9.14
1963	4.32	4.82	5.81	7.79
1964	4.02	4.44	5.36	7.32
1965	3.84	4.29	5.12	6.99
1966	3.57	3.96	4.73	6.46
1967	3.25	3.59	4.30	6.05
1968	3.28	3.63	4.33	6.21
1969	4.09	4.52	5.36	7.78
1970	4.05	4.48	5.29	7.73
1971	3.74	4.11	4.84	7.09
1972	3.10	3.43	4.00	5.80
1973	3.37	3.69	4.33	6.24
1974	3.26	3.58	4.19	5.94
1975	3.31	3.65	4.23	5.99
1976	3.21	3.49	4.05	5.61
1977	2.92	3.14	3.62	4.99
1978	3.06	3.31	3.80	5.16
1979	3.18	3.48	3.98	5.36
1980	3.32	3.72	4.22	5.61
1981	3.77	4.35	4.88	6.39
1982	3.36	3.74	4.23	5.67
1983	2.31	2.64	2.98	3.97
1984	2.12	2.44	2.74	3.65
1985	1.75	2.02	2.27	3.00

Table 14. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	28.58	32.15	39.29	60.71
1941	21.39	24.06	29.41	45.45
1942	17.52	19.15	24.09	37.13
1943	14.46	16.27	19.89	30.73
1944	12.77	14.37	17.56	27.14
1945	11.30	12.71	15.53	24.00
1946	9.44	10.62	12.98	20.06
1947	8.71	9.80	11.98	18.51
1948	8.33	9.37	11.45	17.69
1949	7.73	8.70	10.63	16.43
1950	6.94	7.80	9.54	14.74
1951	9.96	12.08	15.89	25.42
1952	9.13	11.21	14.90	24.04
1953	10.28	12.91	15.12	19.99
1954	9.27	11.64	13.64	18.03
1955	8.95	10.30	12.68	15.29
1956	8.82	9.90	12.08	15.20
1957	8.88	9.92	12.03	15.68
1958	7.59	8.48	10.28	13.40
1959	8.12	9.06	11.06	14.28
1960	7.78	8.63	10.46	13.86
1961	6.32	7.02	8.53	11.37
1962	6.07	6.71	8.09	11.05
1963	5.31	5.83	7.05	9.68
1964	4.97	5.48	6.57	9.23
1965	4.78	5.27	6.32	8.89
1966	4.42	4.88	5.85	8.23
1967	4.06	4.47	5.35	7.58
1968	4.18	4.63	5.45	8.02
1969	5.24	5.76	6.83	9.88
1970	5.16	5.71	6.74	9.66
1971	4.77	5.26	6.17	8.90
1972	4.00	4.40	5.18	7.42
1973	4.34	4.77	5.55	7.99
1974	4.18	4.61	5.35	7.57
1975	4.33	4.71	5.46	7.63
1976	4.14	4.44	5.16	7.14
1977	3.71	3.95	4.57	6.27
1978	3.78	4.10	4.70	6.38
1979	3.93	4.30	4.92	6.62
1980	4.09	4.58	5.20	6.92
1981	4.64	5.34	6.00	7.85
1982	4.14	4.61	5.20	6.98
1983	2.85	3.26	3.67	4.89
1984	2.61	3.00	3.37	4.49
1985	2.15	2.49	2.79	3.70

Table 15. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	4813.72	4079.38	3345.04	2610.69
1941	4820.85	4092.30	3363.76	2635.22
1942	4394.16	3622.86	3076.04	2410.84
1943	3976.54	3385.62	2795.71	2204.79
1944	3950.83	3368.35	2785.86	2203.37
1945	3885.51	3318.14	2750.76	2183.39
1946	3811.99	3263.11	2715.22	2167.33
1947	3170.18	2718.23	2267.11	1815.16
1948	2891.92	2482.27	2072.61	1662.96
1949	2860.07	2459.13	2058.18	1657.23
1950	2883.04	2485.13	2087.99	1690.84
1951	4522.84	4208.77	3781.33	3112.97
1952	4107.61	3884.37	3537.76	2944.39
1953	5131.55	4952.95	3924.89	2645.40
1954	5094.17	4932.38	3915.40	2645.28
1955	5754.95	5066.07	4254.21	2608.79
1956	6114.55	5230.37	4359.79	2802.25
1957	6157.07	5240.00	4335.99	2896.33
1958	5808.68	4959.18	4122.33	2766.65
1959	6256.34	5322.28	4451.22	2950.14
1960	6218.70	5264.72	4372.34	2987.09
1961	5981.21	5098.90	4277.88	2966.47
1962	5846.55	5003.24	4159.92	2954.66
1963	5519.18	4757.43	3995.67	2821.89
1964	5436.35	4650.89	3924.27	2844.64
1965	5638.78	4896.38	4090.28	2977.32
1966	5405.41	4663.66	3916.25	2868.99
1967	5202.92	4481.24	3814.85	2916.28
1968	5060.41	4375.42	3690.44	2889.44
1969	7127.99	6089.65	5030.88	3910.76
1970	6930.35	5927.59	4871.49	3825.08
1971	7188.95	6136.77	5038.52	4000.15
1972	6510.48	5639.88	4649.23	3720.82
1973	8074.82	6881.58	5675.40	4469.21
1974	7647.59	6549.04	5402.30	4179.24
1975	8039.64	6906.35	5620.13	4337.55
1976	8577.06	7243.38	5902.85	4466.56
1977	8912.14	7451.51	6072.96	4622.18
1978	9537.47	8042.51	6485.88	4821.36
1979	9858.21	8400.00	6733.38	4921.17
1980	9938.60	8726.74	6890.92	4938.26
1981	11199.36	10136.18	7843.95	5439.16
1982	9948.80	8673.47	6799.76	4917.71
1983	8143.39	7640.90	6127.96	4602.90
1984	7250.03	6974.56	5632.14	4287.77
1985	5816.18	5931.96	4928.60	3891.16

Table 16. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at Treasury Bond Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5326.34	4511.87	3697.40	2882.93
1941	5374.95	4559.82	3744.70	2929.58
1942	4900.48	4037.92	3424.08	2679.07
1943	4440.19	3776.77	3114.47	2451.05
1944	4405.92	3752.30	3098.67	2445.05
1945	4364.09	3721.94	3079.78	2437.63
1946	4276.06	3654.59	3034.21	2413.84
1947	3602.90	3083.29	2564.60	2044.99
1948	3313.62	2838.05	2362.48	1886.91
1949	3298.32	2828.89	2359.47	1890.05
1950	3365.80	2892.38	2419.83	1947.28
1951	5250.98	4871.27	4362.03	3577.53
1952	4776.99	4500.99	4084.02	3385.12
1953	5985.39	5756.56	4552.71	3060.27
1954	5967.66	5754.49	4557.67	3069.69
1955	6771.68	5944.01	4974.43	3043.03
1956	7234.55	6172.90	5127.02	3284.88
1957	7329.62	6222.35	5130.29	3413.99
1958	6960.23	5923.93	4902.41	3275.03
1959	7492.75	6356.18	5293.27	3493.74
1960	7544.69	6367.85	5263.76	3577.66
1961	7311.74	6207.67	5175.98	3565.21
1962	7358.13	6217.02	5147.53	3648.25
1963	7158.85	6021.87	5026.02	3606.78
1964	7144.44	6045.02	5016.04	3705.34
1965	7503.12	6358.79	5284.29	3916.52
1966	7197.14	6114.63	5100.55	3799.08
1967	7076.48	6018.02	5019.90	3800.53
1968	7060.32	6044.60	4931.56	3889.88
1969	9788.57	8240.43	6723.72	5119.00
1970	9464.28	8024.58	6525.11	4924.04
1971	9909.61	8393.49	6792.05	5184.92
1972	9292.38	7894.33	6479.73	4971.38
1973	11403.82	9651.61	7760.05	5959.61
1974	10768.16	9155.13	7348.40	5551.60
1975	11579.78	9683.16	7754.96	5768.10
1976	12175.30	10004.18	8053.36	5941.56
1977	12564.32	10262.13	8285.71	6105.69
1978	12897.29	10773.18	8572.79	6238.94
1979	13232.66	11167.13	8844.26	6341.61
1980	13239.64	11498.00	8987.54	6333.12
1981	14698.92	13159.66	10109.10	6920.15
1982	13220.53	11407.21	8857.29	6297.11
1983	11455.22	10478.95	8258.83	6023.79
1984	10428.81	9714.66	7686.42	5655.78
1985	8961.18	8654.23	6968.99	5241.77

male retirees. The decrease in valuated benefits (because of an increase in discount rates) causes the exception.

The next set of tables, Table 17 through Table 20, contains relative valuations derived assuming that covered workers choose the S & P 500 Composite Index alternative and assuming risk-free rates are forecasted by the average historical real yield on one-month Treasury bills. This investment alternative is a surrogate for the market portfolio of risky assets. Generally, one should expect to find that, on average, returns from investment in social security, a risk-free alternative, are inferior to returns from investment in this surrogate.

The values in these tables reveal results that are generally opposite to those that should be expected. Out of 184 cases of retired male workers examined, only 19 groups would have been better off by choosing the S & P 500 Composite Index. Out of 184 cases of retired female workers examined, only one group would have been better off by choosing the surrogate. (The easiest way to identify these groups is to examine Table 19 and Table 20 for negative entries.)

When the size of the discount rates is increased as it is in Table 21 through Table 24 (discount rates equal the average historical growth rate of real GNP), there is an increase in the number of inferior results (investment in

Table 17. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	29.89	33.62	41.08	63.48
1941	25.50	28.68	35.06	54.18
1942	23.14	25.29	31.81	49.03
1943	15.80	17.78	21.73	33.58
1944	11.65	13.10	16.01	24.74
1945	9.05	10.18	12.44	19.23
1946	6.37	7.17	8.76	13.54
1947	6.50	7.31	8.94	13.81
1948	5.84	6.56	8.02	12.40
1949	5.43	6.11	7.47	11.54
1950	4.43	4.98	6.08	9.40
1951	5.02	6.09	8.00	12.81
1952	3.78	4.64	6.17	9.95
1953	3.83	4.80	5.63	7.44
1954	3.81	4.78	5.60	7.40
1955	2.73	3.14	3.86	4.66
1956	2.16	2.42	2.96	3.72
1957	2.05	2.29	2.78	3.63
1958	2.25	2.51	3.05	3.97
1959	1.67	1.86	2.28	2.94
1960	1.49	1.65	2.00	2.65
1961	1.48	1.64	2.00	2.66
1962	1.14	1.27	1.53	2.08
1963	1.22	1.36	1.64	2.20
1964	1.00	1.11	1.34	1.83
1965	0.90	1.01	1.20	1.65
1966	0.79	0.88	1.05	1.44
1967	0.90	0.99	1.19	1.67
1968	0.71	0.78	0.94	1.34
1969	0.85	0.94	1.12	1.63
1970	0.95	1.05	1.24	1.82
1971	1.01	1.11	1.31	1.91
1972	0.88	0.97	1.13	1.64
1973	0.90	0.98	1.15	1.66
1974	1.08	1.19	1.39	1.97
1975	1.66	1.83	2.13	3.01
1976	1.36	1.48	1.72	2.38
1977	1.23	1.32	1.52	2.10
1978	1.44	1.56	1.79	2.43
1979	1.46	1.59	1.82	2.45
1980	1.34	1.50	1.70	2.26
1981	1.18	1.36	1.53	2.01
1982	1.23	1.37	1.54	2.07
1983	1.03	1.18	1.33	1.77
1984	0.82	0.94	1.06	1.41
1985	0.77	0.89	1.00	1.33

Table 18. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	33.59	37.78	46.17	71.34
1941	28.88	32.49	39.71	61.36
1942	26.19	28.62	36.00	55.49
1943	17.87	20.10	24.57	37.97
1944	13.14	14.79	18.07	27.92
1945	10.28	11.57	14.14	21.85
1946	7.22	8.12	9.92	15.33
1947	7.45	8.38	10.25	15.83
1948	6.74	7.58	9.27	14.32
1949	6.31	7.10	8.68	13.41
1950	5.19	5.84	7.14	11.03
1951	5.90	7.16	9.42	15.07
1952	4.45	5.46	7.26	11.71
1953	4.53	5.69	6.66	8.81
1954	4.52	5.67	6.65	8.79
1955	3.25	3.74	4.61	5.55
1956	2.59	2.91	3.55	4.46
1957	2.48	2.77	3.36	4.37
1958	2.72	3.04	3.69	4.80
1959	2.03	2.26	2.76	3.56
1960	1.83	2.03	2.46	3.25
1961	1.82	2.02	2.45	3.27
1962	1.43	1.59	1.91	2.61
1963	1.56	1.72	2.07	2.85
1964	1.29	1.42	1.71	2.40
1965	1.17	1.29	1.55	2.18
1966	1.03	1.13	1.36	1.91
1967	1.17	1.29	1.54	2.19
1968	0.95	1.05	1.24	1.82
1969	1.15	1.27	1.50	2.17
1970	1.28	1.41	1.66	2.39
1971	1.36	1.49	1.75	2.53
1972	1.19	1.31	1.54	2.21
1973	1.22	1.34	1.56	2.24
1974	1.46	1.61	1.86	2.64
1975	2.30	2.50	2.90	4.05
1976	1.86	1.99	2.31	3.20
1977	1.65	1.76	2.03	2.79
1978	1.88	2.04	2.34	3.18
1979	1.90	2.08	2.38	3.20
1980	1.74	1.95	2.21	2.94
1981	1.54	1.77	1.99	2.60
1982	1.59	1.78	2.01	2.69
1983	1.34	1.53	1.73	2.30
1984	1.07	1.22	1.38	1.83
1985	1.01	1.16	1.31	1.73

Table 19. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5679.83	4810.43	3941.04	3071.64
1941	5752.01	4875.27	3998.53	3121.79
1942	5299.56	4361.08	3687.67	2874.47
1943	4746.09	4033.97	3323.05	2610.93
1944	4673.39	3984.02	3294.65	2605.29
1945	4540.13	3883.62	3227.11	2570.61
1946	4325.33	3724.07	3124.00	2523.92
1947	3646.18	3138.11	2631.02	2122.95
1948	3285.64	2835.73	2385.83	1935.92
1949	3245.41	2806.97	2368.53	1930.09
1950	3170.24	2760.97	2352.61	1944.24
1951	4858.48	4613.75	4234.37	3568.87
1952	4107.38	4036.61	3819.06	3307.97
1953	5073.66	5118.27	4152.86	2888.49
1954	5116.82	5164.45	4191.43	2916.31
1955	4985.11	4632.15	4132.68	2640.18
1956	4503.38	4144.89	3802.60	2642.34
1957	4319.75	3979.24	3654.25	2692.70
1958	4533.14	4116.44	3714.79	2696.24
1959	3496.74	3372.92	3324.14	2524.99
1960	2863.73	2861.85	2933.21	2418.68
1961	2841.40	2861.31	2954.25	2462.97
1962	1083.80	1548.05	2012.31	2046.19
1963	1536.68	1885.69	2234.69	2094.91
1964	23.80	700.53	1447.27	1773.91
1965	-970.56	65.41	1025.65	1621.07
1966	-2302.42	-1002.63	290.43	1227.29
1967	-1016.57	-73.21	935.95	1668.76
1968	-3543.27	-1968.82	-394.38	1042.34
1969	-1906.36	-544.51	793.00	2057.50
1970	-565.73	445.82	1393.78	2353.30
1971	100.44	963.50	1771.64	2651.16
1972	-1601.64	-299.26	860.07	2093.57
1973	-1567.30	-190.70	1170.46	2531.62
1974	966.04	1698.46	2373.17	2956.50
1975	5521.79	5193.99	4682.55	4175.48
1976	3985.13	3962.81	3932.28	3786.68
1977	3036.76	3201.55	3465.15	3641.80
1978	5213.40	4981.45	4675.23	4239.03
1979	5449.83	5303.21	4904.80	4330.48
1980	4322.31	4776.74	4478.66	4039.67
1981	2873.05	4254.57	4150.05	3909.45
1982	3156.68	3834.27	3787.62	3730.88
1983	523.78	2251.06	2753.81	3241.86
1984	-3718.38	-923.96	575.96	2073.52
1985	-4870.07	-1745.54	19.47	1743.07

Table 20. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	6407.48	5424.35	4441.21	3458.08
1941	6545.49	5544.77	4544.05	3543.33
1942	6029.23	4959.23	4189.23	3261.02
1943	5408.67	4592.95	3778.57	2962.85
1944	5330.40	4538.34	3746.27	2954.21
1945	5235.25	4470.13	3705.01	2939.89
1946	5003.47	4296.14	3590.14	2884.14
1947	4275.98	3669.43	3064.00	2457.45
1948	3901.69	3355.49	2809.29	2263.09
1949	3888.44	3349.52	2810.61	2271.70
1950	3879.84	3359.58	2840.38	2321.18
1951	5930.37	5589.01	5089.21	4252.74
1952	5096.73	4947.97	4626.43	3959.35
1953	6335.60	6305.98	5080.76	3501.64
1954	6420.13	6391.09	5149.75	3549.56
1955	6496.90	5937.58	5203.60	3285.86
1956	6168.70	5546.34	4943.39	3359.96
1957	6057.67	5435.25	4831.55	3459.95
1958	6242.97	5548.92	4873.07	3451.09
1959	5340.67	4914.83	4579.93	3335.69
1960	4837.37	4503.79	4260.03	3297.70
1961	4832.45	4520.52	4298.20	3358.95
1962	3302.08	3340.37	3467.25	3062.56
1963	3921.94	3748.35	3749.23	3226.72
1964	2510.67	2735.09	3046.92	3009.16
1965	1746.63	2218.17	2776.42	2970.52
1966	322.36	1131.52	2025.63	2562.99
1967	1731.00	2183.30	2710.74	2962.65
1968	-625.09	464.66	1433.18	2490.60
1969	1986.50	2613.99	3280.77	3837.51
1970	3176.69	3543.90	3836.18	4001.08
1971	4121.97	4297.08	4365.18	4426.15
1972	2497.50	3033.85	3549.45	3947.42
1973	3359.16	3901.00	4267.61	4748.79
1974	5621.14	5577.93	5290.20	5015.01
1975	10784.82	9354.51	7884.14	6339.40
1976	9390.15	8150.04	7189.48	6024.64
1977	8621.76	7534.28	6861.54	5929.59
1978	10457.93	9243.91	7932.82	6451.82
1979	10754.27	9652.98	8222.97	6563.31
1980	9483.72	9109.80	7756.88	6220.64
1981	8377.33	9010.05	7712.80	6238.81
1982	8318.14	8147.00	7033.57	5907.00
1983	5765.74	6743.11	6126.54	5490.85
1984	1328.88	3426.75	3837.75	4245.65
1985	140.02	2591.14	3269.88	3894.64

Table 21. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	25.46	28.64	35.00	54.09
1941	21.65	24.36	29.78	46.02
1942	19.60	21.42	26.94	41.53
1943	13.43	15.11	18.47	28.54
1944	9.85	11.08	13.55	20.93
1945	7.64	8.59	10.50	16.23
1946	5.37	6.03	7.38	11.40
1947	5.49	6.17	7.55	11.66
1948	4.92	5.54	6.77	10.46
1949	4.57	5.15	6.29	9.72
1950	3.73	4.19	5.12	7.92
1951	4.23	5.13	6.74	10.78
1952	3.18	3.90	5.18	8.36
1953	3.22	4.04	4.73	6.26
1954	3.19	4.00	4.69	6.20
1955	2.29	2.64	3.24	3.91
1956	1.81	2.04	2.49	3.13
1957	1.73	1.93	2.34	3.05
1958	1.89	2.11	2.56	3.34
1959	1.40	1.56	1.91	2.47
1960	1.25	1.39	1.68	2.23
1961	1.24	1.38	1.68	2.24
1962	0.96	1.07	1.29	1.75
1963	1.03	1.15	1.38	1.85
1964	0.84	0.93	1.12	1.53
1965	0.76	0.85	1.01	1.38
1966	0.67	0.74	0.89	1.21
1967	0.75	0.83	1.00	1.40
1968	0.60	0.66	0.79	1.13
1969	0.72	0.79	0.94	1.37
1970	0.80	0.88	1.04	1.52
1971	0.85	0.93	1.10	1.61
1972	0.74	0.81	0.95	1.38
1973	0.75	0.82	0.97	1.39
1974	0.90	0.99	1.16	1.64
1975	1.39	1.53	1.77	2.51
1976	1.13	1.23	1.43	1.98
1977	1.02	1.10	1.26	1.74
1978	1.19	1.29	1.48	2.02
1979	1.21	1.32	1.51	2.03
1980	1.11	1.24	1.41	1.87
1981	0.98	1.13	1.27	1.66
1982	1.01	1.13	1.27	1.71
1983	0.85	0.97	1.09	1.46
1984	0.67	0.77	0.87	1.16
1985	0.64	0.73	0.82	1.09

Table 22. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	28.07	31.58	38.59	59.63
1941	24.01	27.02	33.02	51.03
1942	21.71	23.73	29.85	46.01
1943	14.88	16.74	20.46	31.61
1944	10.89	12.25	14.97	23.13
1945	8.49	9.55	11.67	18.04
1946	5.94	6.68	8.17	12.62
1947	6.14	6.91	8.44	13.05
1948	5.54	6.24	7.62	11.77
1949	5.17	5.82	7.11	10.99
1950	4.25	4.78	5.84	9.03
1951	4.83	5.86	7.70	12.32
1952	3.63	4.46	5.92	9.56
1953	3.69	4.64	5.43	7.18
1954	3.67	4.60	5.39	7.13
1955	2.64	3.04	3.74	4.51
1956	2.10	2.36	2.88	3.63
1957	2.01	2.25	2.73	3.55
1958	2.21	2.47	2.99	3.90
1959	1.64	1.83	2.23	2.89
1960	1.48	1.64	1.99	2.64
1961	1.47	1.63	1.98	2.64
1962	1.16	1.28	1.55	2.11
1963	1.26	1.39	1.68	2.30
1964	1.04	1.15	1.38	1.94
1965	0.95	1.04	1.25	1.76
1966	0.83	0.91	1.10	1.54
1967	0.94	1.04	1.24	1.76
1968	0.76	0.84	0.99	1.46
1969	0.92	1.01	1.20	1.73
1970	1.02	1.12	1.33	1.90
1971	1.08	1.19	1.40	2.01
1972	0.95	1.04	1.23	1.76
1973	0.97	1.07	1.24	1.78
1974	1.16	1.27	1.48	2.09
1975	1.81	1.97	2.29	3.20
1976	1.46	1.57	1.82	2.52
1977	1.30	1.38	1.60	2.19
1978	1.48	1.60	1.84	2.49
1979	1.49	1.63	1.86	2.51
1980	1.37	1.53	1.74	2.31
1981	1.20	1.39	1.56	2.04
1982	1.25	1.39	1.57	2.10
1983	1.05	1.20	1.35	1.80
1984	0.83	0.95	1.07	1.43
1985	0.78	0.90	1.02	1.34

Table 23. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	4810.22	4076.75	3343.29	2609.82
1941	4849.66	4113.91	3378.17	2642.42
1942	4451.42	3665.80	3104.67	2425.16
1943	3985.75	3392.52	2800.31	2207.09
1944	3886.12	3319.81	2753.50	2187.19
1945	3745.23	3212.92	2680.62	2148.32
1946	3513.61	3039.33	2566.04	2092.74
1947	2974.67	2571.60	2169.35	1766.28
1948	2664.71	2311.86	1959.01	1606.15
1949	2617.77	2277.39	1937.02	1596.65
1950	2524.43	2216.17	1908.68	1601.19
1951	3899.76	3741.46	3469.79	2957.20
1952	3216.99	3216.41	3092.45	2721.74
1953	3981.78	4090.62	3350.01	2357.96
1954	3991.82	4105.62	3364.23	2369.69
1955	3721.09	3540.68	3237.28	2100.32
1956	3160.86	3015.10	2882.95	2063.83
1957	2984.34	2860.45	2749.62	2103.15
1958	3235.45	3029.26	2835.72	2123.34
1959	2100.77	2205.60	2373.44	1911.25
1960	1480.10	1710.77	2003.04	1802.44
1961	1434.11	1688.57	2004.32	1829.69
1962	-295.96	396.35	1088.67	1419.03
1963	198.96	767.26	1335.56	1491.84
1964	-1351.84	-440.25	530.18	1147.60
1965	-2410.80	-1140.81	65.49	964.93
1966	-3713.55	-2175.56	-643.23	589.25
1967	-2445.81	-1255.30	-9.51	1004.10
1968	-4904.57	-3098.31	-1292.05	398.19
1969	-3702.81	-2033.44	-384.52	1203.07
1970	-2335.05	-1021.46	238.79	1508.73
1971	-1784.97	-593.68	551.56	1756.67
1972	-3441.45	-1824.07	-326.74	1232.84
1973	-3783.93	-2012.48	-253.98	1504.53
1974	-1211.51	-95.28	972.75	1964.47
1975	3209.15	3283.48	3204.89	3129.93
1976	1475.74	1917.39	2352.19	2691.23
1977	272.46	971.76	1753.12	2462.27
1978	2312.71	2623.93	2873.50	3015.17
1979	2458.13	2849.94	3033.34	3071.15
1980	1392.83	2317.42	2618.04	2801.82
1981	-313.42	1501.60	2087.56	2560.97
1982	177.86	1345.27	1914.29	2474.98
1983	-2514.00	-352.14	799.27	1938.55
1984	-6645.08	-3446.77	-1315.41	813.99
1985	-7787.23	-4270.59	-1873.10	490.30

Table 24. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Standard and Poor's 500 Composite Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5322.84	4509.24	3695.65	2882.06
1941	5403.76	4581.43	3759.11	2936.78
1942	4957.73	4080.86	3452.71	2693.39
1943	4449.40	3783.67	3119.07	2453.35
1944	4341.20	3703.76	3066.31	2428.87
1945	4223.80	3616.72	3009.64	2402.56
1946	3977.68	3430.80	2885.03	2339.25
1947	3407.38	2936.65	2466.84	1996.11
1948	3086.42	2667.65	2248.88	1830.11
1949	3056.01	2647.16	2238.31	1829.47
1950	3007.19	2623.42	2240.53	1857.63
1951	4627.90	4403.96	4050.49	3421.76
1952	3886.38	3833.03	3638.72	3162.46
1953	4835.62	4894.23	3977.83	2772.83
1954	4865.31	4927.73	4006.50	2794.11
1955	4737.82	4418.62	3957.50	2534.56
1956	4280.86	3957.63	3650.17	2546.45
1957	4156.89	3842.80	3543.93	2620.80
1958	4386.99	3994.01	3615.80	2631.72
1959	3337.18	3239.50	3215.48	2454.85
1960	2806.09	2813.90	2894.46	2393.01
1961	2764.63	2797.34	2902.43	2428.43
1962	1215.63	1610.14	2076.28	2112.63
1963	1838.63	2031.71	2365.91	2276.73
1964	356.25	953.89	1621.95	2008.29
1965	-546.46	321.61	1259.50	1904.12
1966	-1921.82	-724.59	541.07	1519.33
1967	-572.25	281.47	1195.53	1888.35
1968	-2904.66	-1429.13	-50.93	1398.64
1969	-1042.22	117.33	1308.32	2411.30
1970	198.88	1075.52	1892.41	2607.69
1971	935.69	1663.05	2305.08	2941.44
1972	-659.55	430.38	1503.76	2483.40
1973	-454.93	757.55	1830.68	2994.92
1974	1909.07	2510.81	2918.85	3336.83
1975	6749.29	6060.29	5339.72	4560.48
1976	5073.98	4678.19	4502.70	4166.23
1977	3924.64	3782.37	3965.88	3945.77
1978	5672.52	5354.60	4960.41	4432.75
1979	5832.58	5617.07	5144.22	4491.59
1980	4693.87	5088.68	4714.66	4196.68
1981	3186.15	4525.08	4352.72	4041.95
1982	3449.59	4079.01	3971.82	3854.37
1983	797.83	2485.90	2930.13	3359.44
1984	-3466.30	-706.67	738.87	2182.01
1985	-4642.23	-1548.32	167.29	1840.92

the surrogate would have been a better choice). However, of 368 possible results, only 52 are inferior.

The results contained in Table 17 through Table 24 demonstrate that inferior results are a function of: (1) date of retirement, (2) gender, and (3) level of historical earnings. The dependency of inferior results on time of retirement is caused by at least two factors: (1) the lengthening of social security investment horizons, and (2) variations in benefit formulas. The first inferior result did not occur until 1962, the time at which investment horizons had increased from 3 years to 23 years. The underlying connection between increases in investment horizons and deteriorations in benefit-cost ratios and net present values is that, ceteris paribus, greater contribution streams are supporting the same level of benefit streams. If the ceteris paribus assumption is abandoned, and benefit levels are allowed to increase, (which is what happens in 1972) then the progression toward more inferior results can be reversed. The examination of relative valuations subsequent to 1972 contained in Table 17 through Table 24 reveals such a reversal. The effects of revisions in benefit formulas (assuming they result in benefit increases) can overcome the adverse effects of lengthening investment horizons. If benefit levels are subsequently allowed to decline, as in 1982, then benefit-cost ratios and net present values subsequently decline.

Inferior results manifest for retired female workers after they manifest for retired male workers. The reason for this occurrence, of course, is that valuations of benefit streams for retired female workers are greater than those of their male counterparts. A greater length of time is needed before valuations of contributions using risky market rates exceed valuated benefit streams.

Finally, the results contained in Table 17 through Table 24 demonstrate that lowest historical income earners benefit most from investment in social security. No inferior results are observed in the tables for the 25% of maximum earners. Additionally, there is a direct, positive relationship between increases in historical earnings and the number of observed inferior results.

The results contained in Table 17 through Table 24 support findings observed in Table 1 through Table 16: (1) retired female workers have better benefit-cost ratios and net present values than male counterparts, (2) earlier retirees generally have better benefit-cost ratios and net present values than later retirees, and (3) the historically lowest income earner benefits the most (without exception) by the incorporation of the social adequacy principle into the social security benefit structure. However, there is far less support for the realization of the hypothesized benefits of the incorporation of the individual equity principle into the

benefit structure than was demonstrated by results contained in Table 1 through Table 16. An emerging pattern can be discerned by the results contained in Table 1 through Table 24. As the opportunity costs of obtaining social security benefits increase, then there is less support for the realization of the hypothesized benefits of the incorporation of the individual equity principle into the benefit structure. This pattern is discussed in more detail later in this chapter.

The next set of tables, Table 25 through Table 28, contain data that are derived under the assumption that investors choose the CRSP Value Weighted Index and benefits are valued using risk-free rates forecasted as the average historical real yield on one-month Treasury bills. The CRSP Value Weighted Index was used as the second surrogate for the market portfolio of risky assets. As might be expected, the results in these tables support those discussed for the S & P 500 Composite Index scenario. That is, inferior results (investment in the surrogate would have been a better alternative) are a function of: (1) date of retirement, (2) historical level of contributions, and (3) gender. Generally, choosing social security as the investment alternative would have been better than choosing the CRSP Value Weighted Index for most covered workers, a result which is antithetical to the expected one.

Table 25. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	29.68	33.38	40.80	63.04
1941	24.92	28.03	34.26	52.95
1942	22.25	24.32	30.59	47.15
1943	15.75	17.72	21.66	33.47
1944	11.44	12.87	15.73	24.31
1945	8.79	9.88	12.08	18.67
1946	6.11	6.87	8.40	12.99
1947	6.12	6.89	8.42	13.01
1948	5.63	6.34	7.74	11.97
1949	5.41	6.09	7.44	11.50
1950	4.36	4.90	5.99	9.26
1951	5.01	6.08	7.99	12.79
1952	3.87	4.75	6.31	10.19
1953	4.09	5.13	6.01	7.94
1954	4.00	5.02	5.88	7.78
1955	2.90	3.34	4.11	4.96
1956	2.41	2.70	3.30	4.15
1957	2.24	2.50	3.04	3.96
1958	2.45	2.73	3.32	4.32
1959	1.81	2.01	2.46	3.18
1960	1.59	1.77	2.14	2.84
1961	1.58	1.75	2.13	2.84
1962	1.22	1.35	1.63	2.21
1963	1.31	1.46	1.75	2.35
1964	1.08	1.20	1.44	1.97
1965	0.98	1.09	1.30	1.78
1966	0.85	0.94	1.12	1.53
1967	0.94	1.04	1.25	1.75
1968	0.73	0.80	0.96	1.38
1969	0.86	0.95	1.13	1.64
1970	0.97	1.08	1.27	1.86
1971	1.06	1.17	1.37	2.01
1972	0.91	1.00	1.17	1.70
1973	0.94	1.03	1.21	1.74
1974	1.16	1.27	1.49	2.11
1975	1.79	1.97	2.29	3.24
1976	1.46	1.58	1.84	2.55
1977	1.29	1.38	1.59	2.20
1978	1.47	1.59	1.82	2.48
1979	1.47	1.61	1.84	2.48
1980	1.31	1.47	1.67	2.22
1981	1.16	1.34	1.50	1.97
1982	1.19	1.33	1.50	2.01
1983	1.01	1.15	1.30	1.73
1984	0.80	0.92	1.03	1.37
1985	0.76	0.88	0.99	1.31

Table 26. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	33.35	37.52	45.85	70.85
1941	28.22	31.75	38.80	59.97
1942	25.18	27.53	34.62	53.37
1943	17.82	20.04	24.50	37.85
1944	12.91	14.53	17.75	27.43
1945	9.98	11.23	13.73	21.21
1946	6.92	7.78	9.51	14.70
1947	7.02	7.89	9.65	14.91
1948	6.51	7.32	8.95	13.83
1949	6.29	7.07	8.64	13.36
1950	5.12	5.75	7.03	10.87
1951	5.90	7.15	9.41	15.05
1952	4.55	5.59	7.43	11.99
1953	4.84	6.07	7.11	9.40
1954	4.75	5.96	6.99	9.24
1955	3.46	3.98	4.90	5.91
1956	2.89	3.24	3.96	4.98
1957	2.70	3.02	3.66	4.77
1958	2.96	3.31	4.01	5.23
1959	2.19	2.44	2.98	3.85
1960	1.95	2.17	2.63	3.48
1961	1.94	2.15	2.62	3.49
1962	1.53	1.69	2.03	2.78
1963	1.67	1.84	2.22	3.05
1964	1.40	1.54	1.85	2.59
1965	1.27	1.40	1.68	2.36
1966	1.10	1.21	1.45	2.04
1967	1.23	1.36	1.62	2.30
1968	0.97	1.08	1.27	1.86
1969	1.16	1.28	1.51	2.19
1970	1.31	1.44	1.70	2.44
1971	1.42	1.57	1.84	2.65
1972	1.23	1.36	1.60	2.29
1973	1.28	1.40	1.63	2.35
1974	1.57	1.73	2.00	2.83
1975	2.47	2.69	3.12	4.36
1976	1.98	2.13	2.47	3.42
1977	1.73	1.84	2.13	2.92
1978	1.92	2.08	2.39	3.24
1979	1.92	2.10	2.40	3.24
1980	1.71	1.91	2.17	2.89
1981	1.51	1.74	1.95	2.55
1982	1.55	1.73	1.95	2.61
1983	1.31	1.50	1.69	2.25
1984	1.04	1.19	1.34	1.79
1985	0.99	1.15	1.29	1.71

Table 27. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5678.45	4809.40	3940.35	3071.30
1941	5746.54	4871.17	3995.79	3120.42
1942	5290.02	4353.92	3682.90	2872.09
1943	4745.09	4033.22	3322.55	2610.68
1944	4665.50	3978.10	3290.71	2603.31
1945	4523.32	3871.02	3218.71	2566.41
1946	4290.88	3698.24	3106.77	2515.31
1947	3605.28	3107.44	2610.57	2112.72
1948	3261.24	2817.43	2373.62	1929.82
1949	3242.74	2804.96	2367.19	1929.42
1950	3156.24	2750.47	2345.60	1940.74
1951	4857.02	4612.66	4233.64	3568.50
1952	4141.52	4062.21	3836.13	3316.50
1953	5186.86	5203.17	4209.46	2916.79
1954	5205.73	5231.13	4235.89	2938.54
1955	5158.90	4762.49	4219.57	2683.63
1956	4903.12	4444.70	4002.47	2742.27
1957	4663.59	4237.11	3826.17	2778.66
1958	4828.21	4337.75	3862.33	2770.01
1959	3883.12	3662.71	3517.33	2621.59
1960	3247.62	3149.77	3125.16	2514.66
1961	3214.12	3140.85	3140.61	2556.16
1962	1538.76	1889.27	2239.78	2159.93
1963	1993.07	2227.98	2462.88	2209.01
1964	663.73	1180.47	1767.23	1933.89
1965	-222.21	626.67	1399.83	1808.16
1966	-1617.72	-489.11	632.78	1398.46
1967	-541.19	283.33	1173.64	1787.61
1968	-3239.27	-1740.82	-242.38	1118.34
1969	-1783.51	-452.38	854.42	2088.21
1970	-296.48	647.76	1528.41	2420.62
1971	657.11	1380.99	2049.97	2790.33
1972	-1144.78	43.38	1088.50	2207.79
1973	-907.37	304.25	1500.43	2696.61
1974	1811.03	2332.20	2795.67	3167.75
1975	6106.40	5632.45	4974.86	4321.63
1976	4696.58	4496.41	4288.01	3964.54
1977	3632.91	3648.66	3763.23	3790.83
1978	5451.98	5160.39	4794.52	4298.68
1979	5566.03	5390.36	4962.89	4359.52
1980	4100.99	4610.76	4368.00	3984.34
1981	2569.26	4026.74	3998.16	3833.51
1982	2751.56	3530.42	3585.06	3629.60
1983	142.98	1965.46	2563.41	3146.66
1984	-4224.88	-1303.84	322.71	1946.90
1985	-5154.43	-1958.81	-122.71	1671.98

Table 28. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	6406.10	5423.31	4440.52	3457.73
1941	6540.02	5540.67	4541.31	3541.96
1942	6019.69	4952.08	4184.46	3258.64
1943	5407.68	4592.20	3778.08	2962.60
1944	5322.51	4532.42	3742.33	2952.24
1945	5218.44	4457.52	3696.60	2935.69
1946	4969.03	4270.31	3572.92	2875.53
1947	4235.08	3638.75	3043.55	2447.23
1948	3877.28	3337.19	2797.09	2256.99
1949	3885.77	3347.52	2809.28	2271.03
1950	3865.84	3349.08	2833.38	2317.68
1951	5928.92	5587.92	5088.49	4252.38
1952	5130.87	4973.57	4643.50	3967.89
1953	6448.81	6390.88	5137.36	3529.94
1954	6509.03	6457.77	5194.20	3571.79
1955	6670.70	6067.92	5290.49	3329.30
1956	6568.44	5846.14	5143.26	3459.89
1957	6401.51	5693.12	5003.47	3545.91
1958	6538.04	5770.22	5020.60	3524.85
1959	5727.06	5204.62	4773.12	3432.29
1960	5221.26	4791.71	4451.98	3393.67
1961	5205.17	4800.06	4484.57	3452.13
1962	3757.04	3681.59	3694.73	3176.30
1963	4378.33	4090.64	3977.43	3340.81
1964	3150.59	3215.04	3366.88	3169.14
1965	2494.98	2779.43	3150.59	3157.60
1966	1007.06	1645.05	2367.98	2734.16
1967	2206.37	2539.83	2948.43	3081.49
1968	-321.08	692.66	1585.18	2566.60
1969	2109.35	2706.12	3342.20	3868.22
1970	3445.95	3745.84	3970.80	4068.39
1971	4678.64	4714.58	4643.52	4565.32
1972	2954.36	3376.50	3777.88	4061.63
1973	4019.09	4395.95	4597.58	4913.78
1974	6466.12	6211.67	5712.69	5226.26
1975	11369.43	9792.96	8176.45	6485.55
1976	10101.60	8683.63	7545.21	6202.50
1977	9217.90	7981.39	7159.61	6078.62
1978	10696.50	9422.85	8052.11	6511.46
1979	10870.47	9740.12	8281.07	6592.36
1980	9262.40	8943.82	7646.22	6165.31
1981	8073.55	8782.22	7560.91	6162.87
1982	7913.01	7843.16	6831.00	5805.72
1983	5384.94	6457.51	5936.14	5395.65
1984	822.38	3046.88	3584.50	4119.03
1985	-144.34	2377.87	3127.70	3823.55

Table 29 through Table 32 contain results derived under the assumption that the chosen alternative is the CRSP Value Weighted Index and risk-free rates are forecasted by the historical average growth rate of real GNP. Similar to the results of the S & P 500 Composite Index scenario, more inferior results manifest. However, the majority of retirees still fare better by investment in social security, even though the relative value of this investment declines. Once again, this is a result not normally expected.

The next set of tables, Table 33 through Table 36, are derived under the assumption that the chosen alternative is the composite portfolio consisting of equal investments in Treasury bills and the S & P 500 Composite Index. Benefit streams used in the derivations of values contained in these tables are valued under the assumption that risk-free rates are forecasted by the average historical real yield on one-month Treasury bills. All benefit-cost ratios exceed unity, and all net present values are greater than zero. Therefore, investment in social security is better than investment in the portfolio, a result that is not normally expected because of the risky nature of the portfolio.

Other findings observed in Table 33 through Table 36 are: (1) benefit-cost ratios and net present values are greater for retired female workers than for their male

Table 29. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	25.28	28.44	34.76	53.71
1941	21.16	23.81	29.10	44.97
1942	18.85	20.60	25.91	39.93
1943	13.39	15.06	18.41	28.45
1944	9.68	10.89	13.31	20.56
1945	7.42	8.35	10.20	15.76
1946	5.15	5.79	7.07	10.93
1947	5.17	5.81	7.11	10.98
1948	4.75	5.34	6.53	10.09
1949	4.56	5.13	6.27	9.69
1950	3.67	4.13	5.05	7.80
1951	4.22	5.12	6.73	10.77
1952	3.25	3.99	5.31	8.56
1953	3.44	4.31	5.05	6.68
1954	3.35	4.21	4.93	6.52
1955	2.44	2.80	3.45	4.16
1956	2.02	2.27	2.77	3.49
1957	1.89	2.11	2.55	3.33
1958	2.06	2.30	2.79	3.64
1959	1.52	1.69	2.06	2.67
1960	1.34	1.49	1.80	2.39
1961	1.33	1.47	1.79	2.39
1962	1.02	1.14	1.37	1.86
1963	1.10	1.23	1.48	1.98
1964	0.91	1.01	1.21	1.66
1965	0.82	0.92	1.09	1.50
1966	0.71	0.79	0.94	1.29
1967	0.79	0.87	1.05	1.47
1968	0.61	0.68	0.81	1.16
1969	0.72	0.80	0.95	1.38
1970	0.82	0.90	1.07	1.56
1971	0.89	0.98	1.15	1.69
1972	0.76	0.84	0.98	1.43
1973	0.79	0.86	1.01	1.46
1974	0.97	1.06	1.24	1.76
1975	1.49	1.64	1.91	2.70
1976	1.21	1.32	1.53	2.12
1977	1.07	1.15	1.32	1.82
1978	1.22	1.32	1.51	2.06
1979	1.22	1.33	1.52	2.05
1980	1.09	1.22	1.38	1.84
1981	0.96	1.11	1.24	1.63
1982	0.98	1.10	1.24	1.66
1983	0.83	0.95	1.07	1.43
1984	0.66	0.76	0.85	1.13
1985	0.63	0.72	0.81	1.08

Table 30. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	27.87	31.36	38.32	59.21
1941	23.47	26.40	32.27	49.87
1942	20.88	22.82	28.70	44.24
1943	14.83	16.68	20.39	31.51
1944	10.70	12.03	14.71	22.73
1945	8.24	9.27	11.33	17.51
1946	5.70	6.41	7.83	12.11
1947	5.78	6.51	7.95	12.29
1948	5.35	6.02	7.36	11.37
1949	5.15	5.80	7.09	10.95
1950	4.19	4.71	5.76	8.89
1951	4.82	5.85	7.69	12.31
1952	3.71	4.56	6.06	9.78
1953	3.94	4.95	5.80	7.66
1954	3.86	4.84	5.67	7.49
1955	2.81	3.24	3.98	4.80
1956	2.35	2.63	3.21	4.04
1957	2.20	2.45	2.98	3.88
1958	2.40	2.69	3.26	4.25
1959	1.77	1.98	2.41	3.12
1960	1.58	1.76	2.13	2.82
1961	1.57	1.74	2.11	2.82
1962	1.23	1.36	1.65	2.25
1963	1.35	1.49	1.80	2.47
1964	1.13	1.24	1.49	2.09
1965	1.02	1.13	1.35	1.90
1966	0.88	0.97	1.17	1.64
1967	0.99	1.09	1.30	1.85
1968	0.78	0.87	1.02	1.50
1969	0.93	1.02	1.21	1.75
1970	1.04	1.15	1.36	1.95
1971	1.14	1.25	1.47	2.12
1972	0.98	1.08	1.28	1.83
1973	1.01	1.11	1.30	1.87
1974	1.24	1.37	1.59	2.25
1975	1.95	2.12	2.46	3.44
1976	1.56	1.68	1.95	2.69
1977	1.36	1.44	1.67	2.29
1978	1.51	1.63	1.87	2.55
1979	1.50	1.64	1.88	2.53
1980	1.34	1.50	1.71	2.27
1981	1.18	1.36	1.53	2.00
1982	1.21	1.35	1.52	2.04
1983	1.02	1.17	1.32	1.76
1984	0.81	0.93	1.05	1.39
1985	0.77	0.89	1.00	1.33

Table 31. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	4808.84	4075.71	3342.59	2609.47
1941	4844.19	4109.81	3375.43	2641.05
1942	4441.88	3658.65	3099.90	2422.77
1943	3984.75	3391.78	2799.82	2206.84
1944	3878.23	3313.89	2749.55	2185.22
1945	3728.42	3200.32	2672.22	2144.11
1946	3479.17	3013.49	2548.81	2084.13
1947	2933.77	2540.92	2148.90	1756.06
1948	2640.31	2293.56	1946.80	1600.05
1949	2615.09	2275.39	1935.69	1595.98
1950	2510.43	2205.67	1901.68	1597.69
1951	3898.31	3740.37	3469.07	2956.84
1952	3251.13	3242.01	3109.52	2730.28
1953	4094.99	4175.53	3406.61	2386.26
1954	4080.73	4172.30	3408.68	2391.92
1955	3894.89	3671.02	3324.17	2143.77
1956	3560.60	3314.91	3082.82	2163.76
1957	3328.18	3118.33	2921.54	2189.11
1958	3530.52	3250.56	2983.25	2197.11
1959	2487.15	2495.39	2566.63	2007.85
1960	1863.99	1998.69	2194.99	1898.42
1961	1806.83	1968.11	2190.69	1922.87
1962	159.00	737.57	1316.14	1532.77
1963	655.35	1109.55	1563.76	1605.93
1964	-711.91	39.70	850.14	1307.58
1965	-1662.45	-579.55	439.67	1152.01
1966	-3028.85	-1662.04	-300.88	760.42
1967	-1970.43	-898.77	228.17	1122.94
1968	-4600.57	-2870.31	-1140.05	474.19
1969	-3579.96	-1941.31	-323.10	1233.78
1970	-2065.80	-819.52	373.41	1576.04
1971	-1228.31	-176.18	829.89	1895.84
1972	-2984.59	-1481.42	-98.31	1347.05
1973	-3123.99	-1517.53	75.99	1669.51
1974	-366.52	538.46	1395.25	2175.72
1975	3793.76	3721.94	3497.19	3276.08
1976	2187.20	2450.98	2707.92	2869.10
1977	868.61	1418.87	2051.20	2611.30
1978	2551.29	2802.87	2992.79	3074.81
1979	2574.32	2937.08	3091.44	3100.20
1980	1171.52	2151.43	2507.38	2746.49
1981	-617.20	1273.77	1935.67	2485.02
1982	-227.26	1041.42	1711.73	2373.70
1983	-2894.80	-637.74	608.87	1843.35
1984	-7151.58	-3826.64	-1568.66	687.37
1985	-8071.58	-4483.86	-2015.28	419.21

Table 32. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Contributions Are Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5321.46	4508.21	3694.96	2881.71
1941	5398.28	4577.33	3756.37	2935.42
1942	4948.20	4073.71	3447.94	2691.00
1943	4448.40	3782.93	3118.57	2453.10
1944	4333.31	3697.84	3062.37	2426.90
1945	4206.99	3604.11	3001.24	2398.36
1946	3943.23	3404.97	2867.80	2330.64
1947	3366.48	2905.98	2446.39	1985.89
1948	3062.01	2649.34	2236.68	1824.01
1949	3053.34	2645.16	2236.98	1828.80
1950	2993.19	2612.92	2233.52	1854.13
1951	4626.45	4402.87	4049.76	3421.39
1952	3920.52	3858.63	3655.78	3171.00
1953	4948.83	4979.14	4034.43	2801.13
1954	4954.22	4994.41	4050.95	2816.33
1955	4911.62	4548.96	4044.40	2578.01
1956	4680.60	4257.44	3850.04	2646.39
1957	4500.73	4100.68	3715.85	2706.76
1958	4682.07	4215.31	3763.33	2705.49
1959	3723.57	3529.29	3408.67	2551.44
1960	3189.98	3101.82	3086.41	2488.98
1961	3137.36	3076.88	3088.79	2521.61
1962	1670.58	1951.35	2303.76	2226.37
1963	2295.02	2374.00	2594.11	2390.82
1964	996.18	1433.83	1941.91	2168.27
1965	201.89	882.87	1633.68	2091.21
1966	-1237.12	-211.07	883.42	1690.51
1967	-96.87	638.01	1433.22	2007.20
1968	-2600.65	-1201.13	101.07	1474.64
1969	-919.38	209.47	1369.75	2442.01
1970	468.13	1277.46	2027.04	2675.00
1971	1492.35	2080.54	2583.42	3080.60
1972	-202.69	773.02	1732.19	2597.61
1973	205.00	1252.50	2160.64	3159.90
1974	2754.06	3144.55	3341.35	3548.08
1975	7333.90	6498.75	5632.02	4706.63
1976	5785.44	5211.79	4858.43	4344.09
1977	4520.79	4229.48	4263.95	4094.81
1978	5911.10	5533.54	5079.70	4492.39
1979	5948.77	5704.21	5202.32	4520.63
1980	4472.56	4922.69	4604.00	4141.35
1981	2882.37	4297.24	4200.82	3966.01
1982	3044.46	3775.16	3769.26	3753.09
1983	417.03	2200.30	2739.73	3264.24
1984	-3972.80	-1086.55	485.62	2055.38
1985	-4926.59	-1761.59	25.11	1769.83

Table 33. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	31.36	35.27	43.11	66.61
1941	25.47	28.65	35.02	54.12
1942	21.81	23.84	29.98	46.21
1943	16.44	18.49	22.60	34.92
1944	13.20	14.85	18.15	28.05
1945	10.86	12.21	14.93	23.07
1946	8.41	9.46	11.57	17.87
1947	8.18	9.20	11.24	17.37
1948	7.37	8.29	10.13	15.66
1949	6.88	7.74	9.46	14.62
1950	5.86	6.60	8.06	12.46
1951	7.10	8.61	11.32	18.11
1952	5.54	6.81	9.05	14.60
1953	5.74	7.21	8.45	11.16
1954	5.59	7.01	8.22	10.86
1955	4.34	4.99	6.14	7.41
1956	3.55	3.99	4.87	6.12
1957	3.35	3.75	4.54	5.92
1958	3.52	3.93	4.77	6.22
1959	2.77	3.09	3.77	4.87
1960	2.47	2.74	3.32	4.40
1961	2.41	2.68	3.26	4.34
1962	1.91	2.13	2.56	3.48
1963	1.98	2.21	2.66	3.57
1964	1.66	1.83	2.21	3.02
1965	1.51	1.68	2.01	2.75
1966	1.33	1.48	1.76	2.41
1967	1.45	1.60	1.92	2.69
1968	1.17	1.29	1.54	2.21
1969	1.41	1.55	1.84	2.68
1970	1.50	1.66	1.96	2.87
1971	1.57	1.73	2.03	2.98
1972	1.38	1.52	1.78	2.58
1973	1.44	1.57	1.85	2.66
1974	1.62	1.78	2.09	2.96
1975	2.21	2.44	2.83	4.00
1976	1.94	2.11	2.44	3.38
1977	1.81	1.94	2.24	3.08
1978	2.02	2.19	2.51	3.41
1979	2.02	2.21	2.53	3.40
1980	1.87	2.09	2.38	3.16
1981	1.72	1.98	2.23	2.92
1982	1.67	1.86	2.10	2.81
1983	1.43	1.63	1.84	2.45
1984	1.16	1.34	1.50	2.00
1985	1.08	1.24	1.40	1.85

Table 34. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	35.24	39.64	48.45	74.86
1941	28.85	32.45	39.66	61.30
1942	24.68	26.98	33.93	52.30
1943	18.59	20.91	25.56	39.49
1944	14.90	16.76	20.49	31.65
1945	12.33	13.88	16.96	26.21
1946	9.52	10.71	13.09	20.24
1947	9.37	10.54	12.89	19.91
1948	8.52	9.58	11.71	18.09
1949	7.99	8.99	10.99	16.99
1950	6.88	7.74	9.46	14.62
1951	8.35	10.13	13.32	21.31
1952	6.52	8.01	10.65	17.18
1953	6.80	8.53	10.00	13.21
1954	6.64	8.33	9.76	12.90
1955	5.17	5.95	7.32	8.83
1956	4.26	4.78	5.83	7.34
1957	4.04	4.52	5.48	7.14
1958	4.26	4.76	5.77	7.52
1959	3.35	3.74	4.57	5.90
1960	3.03	3.36	4.08	5.40
1961	2.96	3.29	4.00	5.33
1962	2.40	2.66	3.20	4.37
1963	2.53	2.78	3.36	4.62
1964	2.14	2.36	2.83	3.97
1965	1.96	2.16	2.59	3.65
1966	1.72	1.90	2.28	3.21
1967	1.89	2.08	2.49	3.53
1968	1.56	1.73	2.03	2.99
1969	1.89	2.08	2.47	3.57
1970	2.02	2.23	2.63	3.77
1971	2.11	2.33	2.73	3.93
1972	1.87	2.06	2.43	3.47
1973	1.95	2.15	2.50	3.59
1974	2.20	2.42	2.81	3.97
1975	3.05	3.32	3.85	5.39
1976	2.64	2.83	3.28	4.54
1977	2.43	2.58	2.99	4.10
1978	2.64	2.86	3.28	4.46
1979	2.64	2.88	3.30	4.44
1980	2.43	2.72	3.09	4.11
1981	2.24	2.58	2.90	3.79
1982	2.17	2.42	2.73	3.66
1983	1.86	2.13	2.40	3.19
1984	1.51	1.74	1.96	2.61
1985	1.40	1.62	1.82	2.41

Table 35. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5689.06	4817.36	3945.65	3073.95
1941	5751.76	4875.08	3998.41	3121.73
1942	5284.95	4350.12	3680.37	2870.82
1943	4758.48	4043.26	3329.24	2614.03
1944	4725.13	4022.83	3320.52	2618.22
1945	4634.10	3954.10	3274.10	2594.10
1946	4520.40	3870.38	3221.53	2572.68
1947	3781.95	3239.94	2698.90	2156.89
1948	3427.10	2941.83	2456.55	1971.28
1949	3399.74	2922.71	2445.69	1968.67
1950	3397.25	2931.23	2466.11	2000.99
1951	5212.44	4879.22	4411.35	3657.36
1952	4577.84	4389.45	4054.29	3425.58
1953	5672.16	5567.14	4452.11	3038.11
1954	5698.41	5600.64	4482.23	3061.71
1955	6056.10	5435.39	4668.17	2907.92
1956	6022.90	5284.53	4562.36	3022.22
1957	5910.53	5172.33	4449.64	3090.40
1958	5845.23	5100.51	4370.84	3024.26
1959	5558.67	4919.37	4355.11	3040.48
1960	5188.42	4605.37	4095.56	2999.85
1961	5132.56	4579.68	4099.83	3035.76
1962	4140.87	3840.85	3540.84	2810.46
1963	4212.78	3892.76	3572.74	2763.93
1964	3418.06	3246.22	3144.40	2622.47
1965	3054.40	3084.13	3038.13	2627.31
1966	2224.35	2392.44	2553.81	2358.98
1967	2765.28	2763.18	2826.87	2614.22
1968	1240.20	1618.78	1997.36	2238.21
1969	3245.45	3319.34	3368.90	3345.45
1970	3670.77	3623.20	3512.03	3412.43
1971	4251.30	4076.64	3847.06	3688.87
1972	3149.44	3264.05	3235.61	3281.34
1973	4165.63	4109.00	4036.93	3964.85
1974	5073.54	4779.09	4426.92	3983.38
1975	7578.24	6736.33	5710.78	4689.60
1976	7240.80	6404.57	5560.12	4600.60
1977	7285.87	6388.38	5589.71	4704.07
1978	8627.57	7542.08	6382.32	5092.58
1979	8772.16	7794.96	6565.96	5161.06
1980	7982.31	7521.74	6308.66	4954.67
1981	7727.25	7895.22	6577.15	5123.00
1982	6854.71	6607.79	5636.64	4655.39
1983	5226.61	5778.18	5105.23	4417.57
1984	2323.32	3607.31	3596.81	3583.95
1985	1168.74	2783.57	3038.87	3252.77

Table 36. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	6416.71	5431.27	4445.83	3460.38
1941	6545.24	5544.58	4543.92	3543.27
1942	6014.62	4948.27	4181.93	3257.37
1943	5421.06	4602.24	3784.77	2965.95
1944	5382.14	4577.14	3772.14	2967.15
1945	5329.21	4540.60	3751.99	2963.38
1946	5198.54	4442.44	3687.68	2932.91
1947	4411.74	3771.25	3131.89	2491.40
1948	4043.15	3461.58	2880.02	2298.45
1949	4042.77	3465.27	2887.78	2310.28
1950	4106.85	3529.83	2953.88	2377.93
1951	6284.33	5854.48	5266.19	4341.23
1952	5567.19	5300.81	4861.66	4076.97
1953	6934.10	6754.85	5380.01	3651.27
1954	7001.71	6827.28	5440.54	3694.96
1955	7567.89	6740.82	5739.09	3553.60
1956	7688.22	6685.98	5703.15	3739.84
1957	7648.45	6628.33	5626.94	3857.64
1958	7555.06	6532.99	5529.11	3779.11
1959	7402.61	6461.29	5610.89	3851.17
1960	7162.06	6247.31	5422.37	3878.87
1961	7123.61	6238.89	5443.79	3931.74
1962	6359.15	5633.17	4995.78	3826.83
1963	6598.03	5755.42	5087.28	3895.74
1964	5904.92	5280.79	4744.04	3857.72
1965	5771.59	5236.89	4788.90	3976.76
1966	4849.12	4526.60	4289.01	3694.68
1967	5512.84	5019.68	4601.66	3908.11
1968	4158.38	4052.27	3824.92	3686.47
1969	7138.31	6477.84	5856.68	5125.46
1970	7413.19	6721.28	5954.43	5060.20
1971	8272.83	7410.22	6440.61	5463.87
1972	7248.58	6597.16	5924.99	5135.19
1973	9092.09	8200.70	7134.08	6182.03
1974	9728.64	8658.55	7343.95	6041.89
1975	12841.27	10896.84	8912.37	6853.51
1976	12645.82	10591.80	8817.32	6838.56
1977	12870.86	10721.10	8986.09	6991.86
1978	13872.10	11804.54	9639.90	7305.36
1979	14076.60	12144.72	9884.13	7393.90
1980	13143.72	11854.80	9586.88	7135.64
1981	13231.53	12650.70	10139.90	7452.36
1982	12016.17	10920.52	8882.58	6831.51
1983	10468.57	10270.24	8477.96	6666.55
1984	7370.58	7958.02	6858.59	5756.08
1985	6178.84	7120.25	6289.29	5404.35

counterparts, (2) benefit-cost ratios increase as the level of historical earnings decreases, an observation which supports the realization of the hypothesized benefits of the incorporation of the social adequacy principle into the social security benefit structure, and (3) earlier retirees generally have superior relative valuations than comparable later retirees. As has been observed previously, there is a breakdown in the hypothesized relationship between net present values and historical levels of earnings as the opportunity costs of obtaining social security benefits increase. That is, there are many examples (especially in the latter half of the study period) when historically low income earners receive not only higher benefit-cost ratios, but also, higher net present values than comparable higher income earners.

Table 37 through Table 40 contain valuations derived under the assumption that the chosen alternative is the portfolio and risk-free rates are forecasted by the average growth rate of real GNP. There are only three cases (all for the maximum male earner) where investment in the portfolio is superior to investment in social security. The valuations in these tables support the conclusions drawn from results contained in Table 33 through Table 36.

Table 37. Benefit-Cost Ratios for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	26.72	30.05	36.73	56.75
1941	21.63	24.34	29.74	45.97
1942	18.47	20.19	25.39	39.14
1943	13.97	15.72	19.21	29.68
1944	11.17	12.57	15.36	23.73
1945	9.17	10.31	12.60	19.48
1946	7.08	7.96	9.74	15.05
1947	6.90	7.76	9.49	14.66
1948	6.22	6.99	8.55	13.21
1949	5.80	6.52	7.97	12.32
1950	4.94	5.56	6.79	10.50
1951	5.97	7.25	9.53	15.25
1952	4.66	5.72	7.60	12.27
1953	4.83	6.06	7.10	9.39
1954	4.68	5.88	6.89	9.10
1955	3.64	4.19	5.16	6.22
1956	2.98	3.35	4.09	5.14
1957	2.82	3.15	3.82	4.98
1958	2.96	3.31	4.01	5.23
1959	2.32	2.59	3.16	4.09
1960	2.08	2.31	2.80	3.70
1961	2.03	2.25	2.74	3.65
1962	1.61	1.79	2.15	2.92
1963	1.67	1.86	2.24	3.01
1964	1.39	1.54	1.86	2.54
1965	1.27	1.42	1.69	2.31
1966	1.12	1.24	1.48	2.03
1967	1.22	1.34	1.61	2.26
1968	0.98	1.09	1.30	1.86
1969	1.18	1.31	1.55	2.25
1970	1.26	1.39	1.65	2.41
1971	1.32	1.45	1.71	2.50
1972	1.16	1.28	1.49	2.17
1973	1.20	1.32	1.55	2.23
1974	1.36	1.49	1.74	2.47
1975	1.84	2.03	2.35	3.33
1976	1.61	1.75	2.03	2.82
1977	1.50	1.61	1.86	2.56
1978	1.68	1.82	2.08	2.83
1979	1.67	1.83	2.09	2.82
1980	1.55	1.74	1.97	2.62
1981	1.42	1.64	1.84	2.41
1982	1.38	1.53	1.73	2.32
1983	1.18	1.35	1.52	2.03
1984	0.96	1.10	1.24	1.65
1985	0.89	1.02	1.15	1.52

Table 38. Benefit-Cost Ratios for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	29.45	33.13	40.49	62.56
1941	23.99	26.99	32.98	50.98
1942	20.46	22.37	28.13	43.36
1943	15.48	17.41	21.28	32.88
1944	12.35	13.89	16.97	26.23
1945	10.18	11.46	14.00	21.64
1946	7.84	8.82	10.78	16.66
1947	7.72	8.69	10.62	16.41
1948	7.00	7.87	9.62	14.87
1949	6.55	7.37	9.01	13.93
1950	5.63	6.33	7.74	11.96
1951	6.83	8.28	10.89	17.42
1952	5.32	6.54	8.69	14.02
1953	5.54	6.96	8.15	10.77
1954	5.39	6.76	7.92	10.47
1955	4.20	4.84	5.95	7.18
1956	3.46	3.88	4.74	5.96
1957	3.29	3.67	4.45	5.81
1958	3.46	3.86	4.69	6.11
1959	2.72	3.03	3.70	4.78
1960	2.45	2.72	3.30	4.37
1961	2.39	2.66	3.23	4.31
1962	1.94	2.15	2.59	3.54
1963	2.05	2.25	2.72	3.74
1964	1.72	1.90	2.28	3.20
1965	1.58	1.74	2.09	2.94
1966	1.39	1.53	1.84	2.58
1967	1.52	1.67	2.00	2.84
1968	1.25	1.39	1.63	2.40
1969	1.51	1.66	1.97	2.85
1970	1.61	1.78	2.10	3.01
1971	1.68	1.85	2.18	3.14
1972	1.49	1.64	1.93	2.77
1973	1.55	1.71	1.99	2.86
1974	1.74	1.92	2.22	3.15
1975	2.41	2.62	3.04	4.25
1976	2.08	2.23	2.59	3.58
1977	1.91	2.03	2.35	3.22
1978	2.08	2.25	2.58	3.50
1979	2.07	2.26	2.58	3.48
1980	1.91	2.14	2.43	3.23
1981	1.75	2.02	2.27	2.96
1982	1.69	1.89	2.13	2.86
1983	1.45	1.66	1.87	2.49
1984	1.18	1.36	1.52	2.03
1985	1.09	1.26	1.42	1.87

Table 39. Net Present Values (Expressed in January, 1937 Dollars) for Men Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	4819.45	4083.67	3347.90	2612.13
1941	4849.41	4113.72	3378.04	2642.36
1942	4436.81	3654.84	3097.37	2421.51
1943	3998.14	3401.81	2806.51	2210.19
1944	3937.86	3358.61	2779.37	2200.12
1945	3839.19	3283.40	2727.60	2171.81
1946	3708.68	3185.63	2663.57	2141.51
1947	3110.44	2673.43	2237.24	1800.22
1948	2806.17	2417.95	2029.73	1641.52
1949	2772.09	2393.14	2014.19	1635.23
1950	2751.44	2386.43	2022.19	1657.94
1951	4253.72	4006.93	3646.77	3045.69
1952	3687.45	3569.26	3327.68	2839.36
1953	4580.28	4539.49	3649.26	2507.59
1954	4573.41	4541.81	3655.02	2515.09
1955	4792.08	4343.92	3772.77	2368.07
1956	4680.38	4154.74	3642.71	2443.71
1957	4575.13	4053.54	3545.01	2500.85
1958	4547.54	4013.32	3491.76	2451.37
1959	4162.70	3752.05	3404.41	2426.73
1960	3804.79	3454.28	3165.39	2383.62
1961	3725.27	3406.94	3149.91	2402.48
1962	2761.11	2689.16	2617.20	2183.30
1963	2875.05	2774.33	2673.61	2160.86
1964	2042.42	2105.44	2227.30	1996.16
1965	1614.16	1877.91	2077.97	1971.17
1966	813.22	1219.51	1620.15	1720.94
1967	1336.04	1581.08	1881.41	1949.56
1968	-121.10	489.29	1099.69	1594.06
1969	1449.00	1830.42	2191.38	2491.02
1970	1901.45	2155.92	2357.04	2567.86
1971	2365.88	2519.46	2626.98	2794.38
1972	1309.63	1739.24	2048.80	2420.61
1973	1949.00	2287.22	2612.49	2937.76
1974	2895.99	2985.34	3026.50	2991.34
1975	5265.60	4825.82	4233.11	3644.04
1976	4731.41	4359.14	3980.03	3505.15
1977	4521.57	4158.58	3877.68	3524.54
1978	5726.88	5184.56	4580.58	3868.71
1979	5780.45	5341.68	4694.51	3901.73
1980	5052.83	5062.42	4448.04	3716.82
1981	4540.78	5142.25	4514.66	3774.52
1982	3875.89	4118.79	3763.31	3399.49
1983	2188.83	3174.98	3150.68	3114.26
1984	-603.39	1084.50	1705.44	2324.42
1985	-1748.41	258.52	1146.31	2000.01

Table 40. Net Present Values (Expressed in January, 1937 Dollars) for Women Who Have Retired as a Consequence of Their Own Covered Employment and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and the Standard and Poor's 500 Composite Index and Benefits Are Discounted at Rates Equal to the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	5332.07	4516.17	3700.27	2884.36
1941	5403.51	4581.24	3758.98	2936.72
1942	4943.12	4069.90	3445.40	2689.73
1943	4461.78	3792.96	3125.27	2456.44
1944	4392.94	3742.56	3092.19	2441.81
1945	4317.77	3687.20	3056.62	2426.05
1946	4172.75	3577.11	2982.56	2388.02
1947	3543.15	3038.48	2534.73	2030.05
1948	3227.87	2773.74	2319.61	1865.48
1949	3210.34	2762.91	2315.48	1868.05
1950	3234.20	2793.68	2354.03	1914.38
1951	4981.86	4669.43	4227.47	3510.25
1952	4356.84	4185.88	3873.94	3280.08
1953	5434.12	5343.10	4277.08	2922.45
1954	5446.90	5363.92	4297.29	2939.50
1955	5808.81	5221.86	4493.00	2802.31
1956	5800.38	5097.27	4409.93	2926.33
1957	5747.68	5035.89	4339.32	3018.50
1958	5699.09	4978.08	4271.84	2959.74
1959	5399.12	4785.95	4246.45	2970.33
1960	5130.77	4557.41	4056.81	2974.18
1961	5055.80	4515.71	4048.01	3001.22
1962	4272.70	3902.94	3604.81	2876.89
1963	4514.72	4038.78	3703.96	2945.75
1964	3750.51	3499.58	3319.08	2856.86
1965	3478.50	3340.33	3271.98	2910.36
1966	2604.94	2670.48	2804.45	2651.03
1967	3209.60	3117.86	3086.46	2833.81
1968	1878.81	2158.47	2340.80	2594.51
1969	4109.59	3981.19	3884.23	3699.25
1970	4435.38	4252.90	4010.66	3666.82
1971	5086.54	4776.19	4380.51	3979.15
1972	4091.53	3993.68	3879.30	3671.17
1973	5278.00	5057.25	4697.14	4428.15
1974	6016.57	5591.43	4972.60	4363.70
1975	8805.74	7602.63	6367.94	5074.59
1976	8329.65	7119.95	6130.54	4980.14
1977	8173.75	6969.20	6090.43	5008.04
1978	9086.69	7915.23	6667.50	5286.29
1979	9154.90	8108.81	6805.38	5322.17
1980	8353.87	7833.68	6544.66	5111.68
1981	8040.35	8165.73	6779.82	5255.50
1982	7147.62	6852.53	5820.84	4778.88
1983	5500.66	6013.03	5281.55	4535.15
1984	2575.39	3824.60	3759.72	3692.43
1985	1396.59	2980.79	3186.69	3350.62

Summary of Results and Implications

The results of this research provide very little support for the central proposition stated in Chapter III. That is, very few groups of retirees would have had larger retirement annuities by investing in any of the alternatives assumed offered by social security. Choosing either of the risk-free surrogates would have been a suboptimal decision for all covered workers, irrespective of the assumed discount rates used in this research to value benefit streams. This finding is of paramount importance. Since social security benefits are risk-free, once entitlement occurs, then valuations of social security benefit streams should be similar to associated contribution streams valued at risk-free yields. Since returns from investment in social security are superior to returns from investment in the risk-free surrogates, then from the perspective of covered workers, "forced" investment in social security has better consequences (larger retirement annuities) than free-choice investment in the surrogates.

Choosing the composite portfolio also would have been a suboptimal decision for all but three groups of maximum male earners. The significance of this finding is that returns from investment in a risk-free fund; that is, social security, are consistently superior to those earned

on a risky alternative. Even more surprising, the results of this research indicate that the majority of covered workers who choose the surrogates for the market portfolio of risky assets as their investment alternatives experience returns inferior to those from investment in social security.

In a market context, returns from investment in social security are clearly excessive. This excessiveness is exacerbated when benefit streams are fully expanded. This expansion involves including all benefits that can be paid based upon a covered worker's investment in social security. Such benefits include those made to auxiliaries and survivors. Obviously, any increase in the level of benefit streams results in positive increases in their valuations. Since valuations of associated contributions do not change, then the number of relative valuations supporting the optimality of investing in alternatives other than social security would be less than the number found in this research.

The observance of excessive returns from investment in social security indicates that amendments to the social security benefit structure may be needed. Congress has demonstrated a willingness to follow a policy of linking social security benefits to market phenomena by indexing nominal benefits to inflation. This policy could be amended to allow the linkage of real returns from

investment in social security to real returns from investment in some surrogate for the risk-free fund, such as the Treasury bill surrogate.¹⁰⁹ The linkage to a risk-free surrogate is appropriate since social security benefits are risk-free.

Without exception, the results of this research support the proposition which states that retired female workers would have benefited less from the alternative investments scenaria than comparable male retirees. The reason for this finding is obvious. Even though retired male workers and comparable retired female workers have the same valuated contribution streams, the valuations of associated benefit streams differ, primarily because of differences in life expectancies. Thus, while investment in social security is generally an optimal decision for each gender, the investment is always better for the retired female worker. If Congress moves toward a more complete policy of linking social security benefits to the functioning of the market, then retired female workers' benefit levels may decline. Once an individual retires in a market scenario, future benefits are not a function of life expectancy, but rather, a function of past investment. Specifically, the cumulative values of contributions to the

¹⁰⁹The Treasury bill surrogate is preferable to the Treasury bond surrogate since investment in Treasury bonds is clearly risky.

dates of retirement are the present values of future benefits. The only difference between comparable retired female and male workers is their life expectancies. Therefore, if the cumulative contributions are paid in the form of annuities, and if the lengths of these annuities match the life expectancies of the covered workers, then the size of the annuities for retired female workers will be less than that of comparable retired male workers.

The results of this research support the proposition which states that earlier retirees would have benefited less from investment in the market alternatives than comparable later retirees. No pre-1960 retirees would have benefited from investing in any of the market alternatives. This finding reflects the effects of earlier retirees enjoying the duration of assumed benefit horizons despite having abbreviated investment horizons.

The comparison of the computed benefit-cost ratios and net present values of earlier retirees to those of comparable later retirees indicates a need for additional research on the effects of investment horizons. In this research, the investment horizons of each succeeding year of retirees are longer than those of the preceeding year of retirees. Thus, while the results of this research demonstrate the effects of the sequential lengthening of investment horizons over time, it does not indicate the effects of investment horizons of same lengths, but which

are placed differently in time. For example, contemporary covered workers must contribute to the social security program a minimum of ten years to be eligible for benefits. A scenario in which all covered workers contribute exactly ten years would allow the examination of the effects upon net present values and benefit-cost ratios of same-length investment horizons which are placed differently in time. In the spirit of this research, a determination could be made as to whether the time dependency of investment horizons impacts the desirability of investing in the market alternatives vis-a-vis that of investing in social security. Unfortunately, the examination of this issue is beyond the scope of this research.

The results of this research support without exception the realization of the hypothesized benefits of the incorporation of the social adequacy principle into the social security benefit structure. That is, there are strict increases in benefit-cost ratios for each year of examination as levels of historical earnings decline. There is less support for the realization of the hypothesized benefits of the incorporation of the social adequacy principle into the structure. There are several cases demonstrating an increase in net present values as historical levels of earnings decline. There is a combination of factors which is associated with the likelihood of observing these anomalies. First, the usage

of surrogates for risky investment alternatives results in more observed anomalies. Second, there are more observed anomalies for male retirees than for comparable female retirees. Third, longer investment horizons tend to be associated with more anomalies than shorter investment horizons. And finally, the anomalies are more likely to occur in comparisons between the maximum earner case and the comparable 75% of maximum earner case.

The method employed by Congress to incorporate the principles of social adequacy and individual equity into the social security benefit structure has inherent weaknesses. The procedure of weighting the benefit structure such that lower income earners receive disproportionately more benefits than comparable higher income earners does not insure social adequacy; it only insures higher imputed rates of return. To insure social adequacy, money benefits have to be linked to some external social adequacy norm, perhaps the defined level of poverty. Since benefits have not been linked to some external norm, then one cannot conclude from the results of this research that the social adequacy goal has or has not been achieved.

However, the results of this research unequivocally prove that social security has achieved the goal of individual equity (in a market context). Since social security benefits are risk-free, after retirement, then the proper comparison of the performance of the social security

benefit structure is against that of the risk-free fund. Since all net present values exceed zero when the risk-free surrogates are used to value contribution streams, then all individuals have received at least the returns that they could have received by investment in the risk-free asset. Thus, while some maximum income earners receive smaller net present values than comparable lower income earners, their investment in social security still yields equitable returns (in a market context).

Since all retired covered workers receive positive net present values when contributions are valued at the yields of the surrogates for the risk-free fund, then all retired covered workers receive subsidies from the government. Past interpretations of the individual equity principle imply that its successful incorporation into the social security benefit structure means that highest income earners receive the largest net present values. Alternatively, the past interpretations imply that highest income earners receive the largest subsidies.

The results of this research indicate that Congress can improve the social security benefit structure by linking it more completely to market phenomena. This course of action would entail linking returns from investment in social security to returns from investment in the risk-free fund. This linkage implies that the interpretation of individual equity would be made

differently than in the past. The interpretation would be related to returns from investment in the proper market alternative; that is, the risk-free fund. The successful implementation of the individual equity principle would mean that retired covered workers' returns from investment in social security are comparable to those from investment in the risk-free fund. A market-based benefit structure would provide an external norm for defining individual equity. Pairwise comparisons of net present values would be made irrelevant by usage of the external norm.

The implementation of the social adequacy principle also should be related to an external norm. Large imputed rates of return, such as those offered by the current benefit structure, do not guarantee the achievement of social adequacy. The usage of an external norm is more desirable. If an external norm is used, then the pattern of subsidies observed in this research would change; that is, lower income earners would receive larger subsidies than comparable higher income earners.

Conclusions

The stated goal of this research has been achieved; that is, the comparison of the performance of the social security benefit structure with various market alternatives has been made. The conclusions are that social security always outperforms the surrogates for the risk-free asset

and generally outperforms the surrogates for the market portfolio of risky assets. These conclusions are alarming in view of the risk-free nature of social security benefits.

The major policy action indicated in this research is that the social security benefit structure should be linked more completely with market-based phenomena. This linkage would provide a clearly defined standard for assessing the achievement of individual equity. Also, an external norm is needed for assessing achievement of social adequacy. The current social security benefit plan, in all likelihood, lacks optimality because its basis of structure, the concepts of social adequacy and individual equity, are nebulously defined. A benefit structure that is properly related to market phenomena, and the usage of a proper social adequacy norm would result in a more optimal plan.

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APPENDIX

DATA USED TO COMPUTE BENEFIT-COST RATIOS AND NET PRESENT VALUES

Table A-1. Compounded Real Contributions (Expressed in January, 1937 Dollars) for Individuals Retiring in January of Each Year, 1940-1985, and When Compounding of Contributions Is at Treasury Bill Yields.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	178.17	133.63	89.09	44.54
1941	235.30	176.48	117.65	58.83
1942	268.60	201.45	134.30	67.15
1943	295.83	221.87	147.91	73.96
1944	335.44	251.58	167.72	83.86
1945	376.20	282.15	188.10	94.05
1946	414.78	311.08	207.39	103.69
1947	391.23	293.42	195.61	97.81
1948	396.52	297.39	198.26	99.13
1949	423.65	317.74	211.83	105.91
1950	471.42	353.56	235.71	117.85
1951	501.21	375.91	250.60	125.30
1952	537.30	402.97	268.65	134.32
1953	597.48	448.11	298.74	149.37
1954	660.35	495.26	330.17	165.09
1955	743.87	557.91	371.94	185.97
1956	839.81	629.86	419.91	209.95
1957	921.53	691.15	460.76	230.38
1958	1005.41	754.06	502.70	251.35
1959	1083.66	812.75	541.83	270.92
1960	1202.05	901.53	601.02	300.51
1961	1339.40	1004.55	669.70	334.85
1962	1481.03	1110.78	740.52	370.26
1963	1629.91	1222.43	814.95	407.48
1964	1799.90	1349.92	899.95	449.97
1965	1986.23	1489.67	993.11	496.56
1966	2167.57	1625.68	1083.79	541.89
1967	2394.63	1795.97	1197.31	598.66
1968	2615.49	1961.62	1307.74	653.87
1969	2834.25	2125.69	1417.13	708.56
1970	3066.10	2299.58	1533.05	766.53
1971	3299.08	2474.31	1649.54	824.77
1972	3548.23	2661.17	1774.11	887.06
1973	3803.41	2852.56	1901.71	950.85
1974	4025.99	3019.49	2012.99	1006.50
1975	4195.09	3146.32	2097.55	1048.77
1976	4462.34	3346.76	2231.17	1115.59
1977	4778.39	3583.79	2389.20	1194.60
1978	5033.87	3775.40	2516.94	1258.47
1979	5268.67	3951.50	2634.33	1317.17
1980	5506.66	4130.00	2753.33	1376.67
1981	5844.44	4383.33	2922.22	1461.11
1982	6589.03	4941.78	3294.52	1647.26
1983	7446.64	5584.98	3723.32	1861.66
1984	8285.85	6214.39	4142.93	2071.46
1985	9290.76	6968.07	4645.38	2322.69

Table A-2. Maximum Real Quarterly Contributions Compounded at Treasury Bill^a Yields and the Associated Input Variables.

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill ^b Yields	Inflation Rates ^c
1 Q 1937	14.63	14.63	0.0004	0.0168
2 Q 1937	28.90	14.42	0.0012	0.0117
3 Q 1937	42.71	14.25	0.0009	0.0162
4 Q 1937	57.62	14.30	0.0004	-0.0137
1 Q 1938	73.62	14.64	-0.0001	-0.0232
2 Q 1938	88.29	14.66	0.0001	0.0000
3 Q 1938	102.97	14.67	0.0001	-0.0000
4 Q 1938	118.18	14.77	-0.0005	-0.0047
1 Q 1939	134.48	14.89	-0.0001	-0.0120
2 Q 1939	149.80	14.97	0.0002	-0.0024
3 Q 1939	161.84	14.87	-0.0000	0.0193
4 Q 1939	178.17	14.78	0.0000	-0.0095
1 Q 1940	192.56	14.80	0.0000	0.0024
2 Q 1940	206.36	14.76	-0.0002	0.0048
3 Q 1940	221.63	14.77	-0.0000	-0.0024
4 Q 1940	235.30	14.73	0.0000	0.0048
1 Q 1941	248.84	14.66	-0.0001	0.0047
2 Q 1941	254.63	14.32	-0.0001	0.0354
3 Q 1941	260.75	13.88	0.0005	0.0320
4 Q 1941	268.60	13.45	0.0001	0.0220
1 Q 1942	272.81	13.09	0.0004	0.0346
2 Q 1942	280.67	12.76	0.0006	0.0189
3 Q 1942	290.11	12.59	0.0009	0.0122
4 Q 1942	295.83	12.34	0.0009	0.0243
1 Q 1943	303.08	12.17	0.0009	0.0178
2 Q 1943	309.93	11.84	0.0008	-0.0176
3 Q 1943	324.49	11.94	0.0009	-0.0075
4 Q 1943	335.44	11.88	0.0009	0.0038
1 Q 1944	348.90	11.92	0.0008	-0.0038
2 Q 1944	357.04	11.81	0.0009	0.0115
3 Q 1944	365.64	11.69	0.0008	0.0095
4 Q 1944	376.20	11.65	0.0008	0.0038
1 Q 1945	388.82	11.64	0.0007	-0.0019
2 Q 1945	393.49	11.53	0.0008	0.0188
3 Q 1945	406.02	11.43	0.0009	-0.0019
4 Q 1945	414.78	11.42	0.0008	0.0074
1 Q 1946	425.00	11.37	0.0009	0.0037
2 Q 1946	427.43	11.19	0.0009	0.0219
3 Q 1946	401.03	10.28	0.0009	0.0949
4 Q 1946	391.23	9.75	0.0009	0.0522
1 Q 1947	393.41	9.57	0.0009	0.0202
2 Q 1947	401.40	9.43	0.0009	0.0046
3 Q 1947	394.12	9.17	0.0012	0.0440
4 Q 1947	396.52	8.92	0.0020	0.0189
1 Q 1948	406.22	8.79	0.0023	-0.0000
2 Q 1948	404.62	8.64	0.0025	0.0284
3 Q 1948	407.28	8.46	0.0021	0.0167
4 Q 1948	423.65	8.54	0.0012	-0.0177
1 Q 1949	437.72	8.66	0.0029	-0.0097
2 Q 1949	447.05	8.67	0.0029	0.0014
3 Q 1949	456.97	8.70	0.0027	0.0000
4 Q 1949	471.42	8.73	0.0026	-0.0098
1 Q 1950	487.22	13.19	0.0028	-0.0027
2 Q 1950	496.29	13.09	0.0029	0.0112
3 Q 1950	498.33	12.79	0.0030	0.0252
4 Q 1950	501.21	12.54	0.0034	0.0233
1 Q 1951	501.85	14.53	0.0034	0.0320
2 Q 1951	516.14	14.38	0.0037	0.0039

Table A-2 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Inflation Rates
3 Q 1951	528.46	14.33	0.0038	0.0077
4 Q 1951	537.30	14.13	0.0039	-0.0141
1 Q 1952	556.89	14.13	0.0038	-0.0063
2 Q 1952	568.97	14.08	0.0040	0.0076
3 Q 1952	581.22	13.94	0.0046	0.0076
4 Q 1952	597.48	13.93	0.0040	-0.0000
1 Q 1953	617.39	14.02	0.0048	-0.0050
2 Q 1953	629.81	13.96	0.0051	0.0076
3 Q 1953	642.78	13.85	0.0048	0.0062
4 Q 1953	660.35	13.83	0.0034	-0.0024
1 Q 1954	680.46	18.45	0.0026	0.0001
2 Q 1954	698.67	18.47	0.0020	0.0024
3 Q 1954	721.05	18.46	0.0019	-0.0037
4 Q 1954	743.87	18.55	0.0021	-0.0038
1 Q 1955	767.55	21.66	0.0027	0.0000
2 Q 1955	791.82	21.66	0.0034	0.0000
3 Q 1955	812.87	21.60	0.0042	0.0049
4 Q 1955	839.81	21.56	0.0053	-0.0013
1 Q 1956	866.13	21.61	0.0056	-0.0000
2 Q 1956	882.24	21.44	0.0062	0.0124
3 Q 1956	901.94	21.17	0.0057	0.0074
4 Q 1956	921.53	21.02	0.0069	0.0085
1 Q 1957	942.61	20.89	0.0074	0.0072
2 Q 1957	959.08	20.68	0.0075	0.0120
3 Q 1957	980.50	20.47	0.0081	0.0071
4 Q 1957	1005.41	20.39	0.0081	0.0035
1 Q 1958	1016.42	20.19	0.0049	0.0142
2 Q 1958	1035.13	20.03	0.0022	0.0035
3 Q 1958	1058.25	20.01	0.0030	-0.0000
4 Q 1958	1083.66	20.01	0.0051	-0.0000
1 Q 1959	1116.12	25.72	0.0062	-0.0000
2 Q 1959	1141.33	25.65	0.0066	0.0070
3 Q 1959	1170.13	25.49	0.0075	0.0046
4 Q 1959	1202.05	25.35	0.0090	0.0034
1 Q 1960	1244.74	31.00	0.0097	-0.0000
2 Q 1960	1274.30	30.79	0.0070	0.0080
3 Q 1960	1309.49	30.73	0.0046	0.0011
4 Q 1960	1339.40	30.55	0.0051	0.0056
1 Q 1961	1377.05	30.54	0.0053	0.0000
2 Q 1961	1413.64	30.53	0.0055	0.0011
3 Q 1961	1443.04	30.37	0.0049	0.0056
4 Q 1961	1481.03	30.34	0.0053	0.0000
1 Q 1962	1515.64	31.64	0.0064	0.0044
2 Q 1962	1553.82	31.51	0.0066	0.0022
3 Q 1962	1584.28	31.38	0.0071	0.0077
4 Q 1962	1629.91	31.31	0.0068	-0.0022
1 Q 1963	1672.81	36.71	0.0071	0.0033
2 Q 1963	1714.10	36.61	0.0072	0.0044
3 Q 1963	1756.45	36.34	0.0079	0.0044
4 Q 1963	1799.90	36.24	0.0085	0.0044
1 Q 1964	1849.77	36.16	0.0087	0.0011
2 Q 1964	1895.48	36.08	0.0085	0.0033
3 Q 1964	1941.48	35.94	0.0086	0.0033
4 Q 1964	1986.23	35.81	0.0089	0.0043
1 Q 1965	2038.50	35.74	0.0094	0.0011
2 Q 1965	2072.17	35.49	0.0097	0.0106
3 Q 1965	2124.96	35.33	0.0095	0.0011
4 Q 1965	2167.57	35.18	0.0099	0.0064
1 Q 1966	2221.03	49.76	0.0111	0.0094
2 Q 1966	2276.95	49.26	0.0113	0.0083

Table A-2 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Inflation Rates
3 Q 1966	2328.93	48.80	0.0116	0.0102
4 Q 1966	2394.63	48.44	0.0126	0.0051
1 Q 1967	2464.77	49.03	0.0118	0.0030
2 Q 1967	2516.42	48.70	0.0092	0.0080
3 Q 1967	2563.10	48.18	0.0094	0.0100
4 Q 1967	2615.49	47.79	0.0108	0.0090
1 Q 1968	2667.84	52.35	0.0117	0.0117
2 Q 1968	2723.60	51.76	0.0132	0.0116
3 Q 1968	2782.06	51.13	0.0134	0.0106
4 Q 1968	2834.25	50.52	0.0130	0.0123
1 Q 1969	2889.11	55.97	0.0146	0.0150
2 Q 1969	2942.69	55.00	0.0153	0.0158
3 Q 1969	3005.42	54.23	0.0166	0.0137
4 Q 1969	3066.10	53.49	0.0177	0.0153
1 Q 1970	3129.36	51.64	0.0180	0.0142
2 Q 1970	3181.74	50.82	0.0162	0.0157
3 Q 1970	3250.11	50.26	0.0160	0.0102
4 Q 1970	3299.08	49.61	0.0135	0.0137
1 Q 1971	3367.56	54.63	0.0101	0.0059
2 Q 1971	3405.85	54.01	0.0094	0.0142
3 Q 1971	3481.81	53.48	0.0125	0.0058
4 Q 1971	3548.23	53.20	0.0111	0.0073
1 Q 1972	3611.98	60.90	0.0081	0.0073
2 Q 1972	3675.26	60.40	0.0088	0.0080
3 Q 1972	3734.40	59.86	0.0094	0.0096
4 Q 1972	3803.41	59.32	0.0114	0.0088
1 Q 1973	3854.24	74.55	0.0132	0.0195
2 Q 1973	3910.35	72.94	0.0155	0.0199
3 Q 1973	3969.62	71.37	0.0203	0.0235
4 Q 1973	4025.99	69.75	0.0186	0.0221
1 Q 1974	4050.14	84.36	0.0178	0.0333
2 Q 1974	4110.96	82.04	0.0211	0.0265
3 Q 1974	4145.22	79.62	0.0212	0.0326
4 Q 1974	4195.09	77.36	0.0176	0.0244
1 Q 1975	4271.67	81.16	0.0143	0.0154
2 Q 1975	4331.24	79.91	0.0130	0.0178
3 Q 1975	4393.63	78.23	0.0150	0.0187
4 Q 1975	4462.34	77.01	0.0146	0.0165
1 Q 1976	4566.95	82.76	0.0121	0.0072
2 Q 1976	4614.48	62.05	0.0122	0.0155
3 Q 1976	4688.53	80.47	0.0134	0.0148
4 Q 1976	4778.39	79.57	0.0121	0.0099
1 Q 1977	4809.35	84.33	0.0109	0.0224
2 Q 1977	4850.94	82.55	0.0115	0.0202
3 Q 1977	4936.66	81.37	0.0130	0.0120
4 Q 1977	5033.87	80.46	0.0149	0.0114
1 Q 1978	5094.88	82.98	0.0149	0.0193
2 Q 1978	5108.92	80.86	0.0160	0.0295
3 Q 1978	5177.80	79.01	0.0175	0.0195
4 Q 1978	5268.67	77.47	0.0218	0.0191
1 Q 1979	5330.19	98.98	0.0233	0.0306
2 Q 1979	5379.71	95.77	0.0245	0.0335
3 Q 1979	5420.40	92.65	0.0239	0.0339
4 Q 1979	5506.66	90.02	0.0284	0.0291
1 Q 1980	5535.94	102.28	0.0293	0.0431
2 Q 1980	5605.07	98.71	0.0270	0.0325
3 Q 1980	5717.12	96.89	0.0193	0.0166
4 Q 1980	5844.44	94.42	0.0325	0.0266
1 Q 1981	5997.70	109.68	0.0336	0.0259
2 Q 1981	6180.21	107.20	0.0362	0.0234

Table A-2 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Inflation Rates
3 Q 1981	6336.00	104.21	0.0381	0.0295
4 Q 1981	6589.03	102.74	0.0318	0.0079
1 Q 1982	6838.36	108.21	0.0272	0.0057
2 Q 1982	6981.05	106.58	0.0318	0.0264
3 Q 1982	7182.81	104.60	0.0234	0.0093
4 Q 1982	7446.64	104.39	0.0190	-0.0031
1 Q 1983	7686.39	120.10	0.0195	0.0034
2 Q 1983	7841.03	118.62	0.0208	0.0161
3 Q 1983	8038.96	117.21	0.0228	0.0123
4 Q 1983	8285.85	116.21	0.0221	0.0057
1 Q 1984	8497.07	132.55	0.0222	0.0125
2 Q 1984	8733.60	131.11	0.0236	0.0110
3 Q 1984	8976.01	129.71	0.0253	0.0122
4 Q 1984	9290.76	128.78	0.0239	0.0031

^aContributions and their compounded values are expressed in January, 1937 dollars.

^bIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook (Chicago, 1987), p. 127.

^cIbid., p. 128.

Table A-3. Compounded Real Contributions (Expressed in January, 1937 Dollars) for Individuals Retiring in January of Each Year, 1940-1985, and When Compounding of Contributions Is at Treasury Bond Yields.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	193.14	144.85	96.57	48.28
1941	263.61	197.71	131.81	65.90
1942	296.63	222.47	148.32	74.16
1943	329.80	247.35	164.90	82.45
1944	374.20	280.65	187.10	93.55
1945	423.85	317.89	211.92	105.96
1946	506.53	379.90	253.27	126.63
1947	467.25	350.44	233.62	116.81
1948	452.22	339.17	226.11	113.06
1949	490.00	367.50	245.00	122.50
1950	566.82	425.11	283.41	141.70
1951	586.04	439.53	293.02	146.51
1952	587.60	440.70	293.80	146.90
1953	644.71	483.53	322.35	161.18
1954	721.18	540.88	360.59	180.29
1955	851.99	638.99	425.99	213.00
1956	925.16	693.87	462.58	231.29
1957	930.37	697.78	465.18	232.59
1958	1056.36	792.27	528.18	264.09
1959	1051.97	788.97	525.98	262.99
1960	1112.82	834.61	556.41	278.20
1961	1374.62	1030.96	687.31	343.65
1962	1452.66	1089.50	726.33	363.17
1963	1661.87	1246.41	830.94	415.47
1964	1800.23	1350.17	900.11	450.06
1965	1986.56	1489.92	993.28	496.64
1966	2102.14	1576.60	1051.07	525.53
1967	2309.59	1732.19	1154.80	577.40
1968	2217.45	1663.09	1108.72	554.36
1969	2307.08	1730.31	1153.54	576.77
1970	2273.70	1705.28	1136.85	568.43
1971	2626.86	1970.14	1313.43	656.71
1972	3098.45	2323.84	1549.23	774.61
1973	3410.52	2557.89	1705.26	852.63
1974	3381.89	2536.42	1690.94	845.47
1975	3477.51	2608.13	1738.75	869.38
1976	3872.37	2904.28	1936.19	968.09
1977	4636.92	3477.69	2318.46	1159.23
1978	4637.45	3478.08	2318.72	1159.36
1979	4513.24	3384.93	2256.62	1128.31
1980	4280.89	3210.67	2140.45	1070.22
1981	4040.07	3030.05	2020.03	1010.02
1982	4214.15	3160.62	2107.08	1053.54
1983	6194.91	4646.18	3097.45	1548.73
1984	6474.13	4855.60	3237.07	1618.53
1985	7764.98	5823.74	3882.49	1941.25

Table A-4. Maximum Real Quarterly Contributions Compounded at Treasury Bond^a Yields and the Associated Input Variables.

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total Treasury Bond ^b Yields	Inflation Rates
1	Q	1937	14.63	14.63	-0.0342	0.0168
2	Q	1937	28.99	14.42	0.0074	0.0117
3	Q	1937	43.00	14.25	0.0078	0.0162
4	Q	1937	58.86	14.30	0.0222	-0.0137
1	Q	1938	75.33	14.64	0.0072	-0.0232
2	Q	1938	91.94	14.66	0.0259	0.0000
3	Q	1938	107.21	14.67	0.0065	-0.0000
4	Q	1938	124.06	14.77	0.0145	-0.0047
1	Q	1939	143.79	14.89	0.0266	-0.0120
2	Q	1939	162.90	14.97	0.0263	-0.0024
3	Q	1939	164.61	14.87	-0.0630	0.0193
4	Q	1939	193.14	14.78	0.0732	-0.0095
1	Q	1940	211.09	14.80	0.0187	0.0024
2	Q	1940	223.08	14.76	-0.0084	0.0048
3	Q	1940	242.66	14.77	0.0191	-0.0024
4	Q	1940	263.61	14.73	0.0305	0.0048
1	Q	1941	274.75	14.66	-0.0087	0.0047
2	Q	1941	285.61	14.32	0.0223	0.0354
3	Q	1941	291.42	13.88	0.0028	0.0320
4	Q	1941	296.63	13.45	-0.0068	0.0220
1	Q	1942	304.76	13.09	0.0173	0.0346
2	Q	1942	313.32	12.76	0.0049	0.0189
3	Q	1942	323.95	12.59	0.0059	0.0122
4	Q	1942	329.80	12.34	0.0038	0.0243
1	Q	1943	337.36	12.17	0.0036	0.0178
2	Q	1943	347.25	11.84	0.0116	0.0176
3	Q	1943	362.90	11.94	0.0031	-0.0075
4	Q	1943	374.20	11.88	0.0022	0.0038
1	Q	1944	390.33	11.92	0.0074	-0.0038
2	Q	1944	399.58	11.81	0.0049	0.0115
3	Q	1944	410.55	11.69	0.0077	0.0095
4	Q	1944	423.85	11.65	0.0078	0.0038
1	Q	1945	445.91	11.64	0.0226	-0.0019
2	Q	1945	466.27	11.53	0.0390	0.0188
3	Q	1945	478.28	11.43	-0.0007	-0.0019
4	Q	1945	506.53	11.42	0.0429	0.0074
1	Q	1946	519.44	11.37	0.0067	0.0037
2	Q	1946	515.51	11.19	-0.0078	0.0219
3	Q	1946	473.58	10.28	-0.0160	0.0949
4	Q	1946	467.25	9.75	0.0165	0.0522
1	Q	1947	469.18	9.57	0.0035	0.0202
2	Q	1947	476.75	9.43	0.0006	0.0046
3	Q	1947	470.40	9.17	0.0100	0.0440
4	Q	1947	452.22	8.92	-0.0398	0.0189
1	Q	1948	465.55	8.79	0.0100	-0.0000
2	Q	1948	465.89	8.64	0.0101	0.0284
3	Q	1948	466.44	8.46	-0.0006	0.0167
4	Q	1948	490.00	8.54	0.0140	-0.0177
1	Q	1949	513.69	8.66	0.0206	-0.0097
2	Q	1949	531.78	8.67	0.0198	0.0014
3	Q	1949	547.58	8.70	0.0133	0.0000
4	Q	1949	566.82	8.73	0.0092	-0.0098
1	Q	1950	579.73	13.19	-0.0032	-0.0027
2	Q	1950	588.55	13.09	0.0038	0.0112
3	Q	1950	586.67	12.79	-0.0003	0.0252
4	Q	1950	586.04	12.54	0.0003	0.0233
1	Q	1951	572.57	14.53	-0.0173	0.0320
2	Q	1951	573.73	14.38	-0.0193	0.0039

Table A-4 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bond Yields	Inflation Rates
3 Q 1951	592.58	14.33	0.0156	0.0077
4 Q 1951	587.60	14.13	-0.0186	0.0141
1 Q 1952	614.53	14.13	0.0154	-0.0063
2 Q 1952	632.47	14.08	0.0139	0.0076
3 Q 1952	627.91	13.94	-0.0219	0.0076
4 Q 1952	644.71	13.93	0.0046	-0.0000
1 Q 1953	651.44	14.02	-0.0162	-0.0050
2 Q 1953	658.27	13.96	-0.0034	0.0076
3 Q 1953	689.70	13.85	0.0331	0.0062
4 Q 1953	721.18	13.83	0.0231	-0.0024
1 Q 1954	767.76	18.45	0.0391	0.0001
2 Q 1954	798.14	18.47	0.0179	0.0024
3 Q 1954	826.57	18.46	0.0087	-0.0037
4 Q 1954	851.99	18.55	0.0045	-0.0038
1 Q 1955	853.81	21.66	-0.0233	0.0000
2 Q 1955	875.25	21.66	-0.0003	0.0000
3 Q 1955	890.34	21.60	-0.0026	0.0049
4 Q 1955	925.16	21.56	0.0136	-0.0013
1 Q 1956	940.37	21.61	-0.0069	-0.0000
2 Q 1956	962.95	21.44	0.0137	0.0124
3 Q 1956	944.26	21.17	-0.0343	0.0074
4 Q 1956	930.37	21.02	-0.0288	0.0085
1 Q 1957	976.65	20.89	0.0347	0.0072
2 Q 1957	945.17	20.68	-0.0420	0.0120
3 Q 1957	962.40	20.47	0.0037	0.0071
4 Q 1957	1056.36	20.39	0.0802	0.0035
1 Q 1958	1074.02	20.19	0.0117	0.0142
2 Q 1958	1092.87	20.03	0.0024	0.0035
3 Q 1958	1024.28	20.01	-0.0811	-0.0000
4 Q 1958	1051.97	20.01	0.0075	-0.0000
1 Q 1959	1083.28	25.72	0.0053	-0.0000
2 Q 1959	1089.22	25.65	-0.0113	0.0070
3 Q 1959	1105.57	25.49	-0.0038	0.0046
4 Q 1959	1112.82	25.35	-0.0130	0.0034
1 Q 1960	1211.62	31.00	0.0609	-0.0000
2 Q 1960	1251.05	30.79	0.0152	0.0080
3 Q 1960	1327.37	30.73	0.0376	0.0011
4 Q 1960	1374.62	30.55	0.0183	0.0056
1 Q 1961	1364.94	30.54	-0.0293	0.0000
2 Q 1961	1393.00	30.53	-0.0007	0.0011
3 Q 1961	1433.04	30.37	0.0126	0.0056
4 Q 1961	1452.66	30.34	-0.0075	0.0000
1 Q 1962	1527.70	31.64	0.0344	0.0044
2 Q 1962	1563.69	31.51	0.0051	0.0022
3 Q 1962	1604.43	31.38	0.0137	0.0077
4 Q 1962	1661.87	31.31	0.0141	-0.0022
1 Q 1963	1695.76	36.71	0.0016	0.0033
2 Q 1963	1730.00	36.61	0.0030	0.0044
3 Q 1963	1768.42	36.34	0.0056	0.0044
4 Q 1963	1800.23	36.24	0.0019	0.0044
1 Q 1964	1836.56	36.16	0.0012	0.0011
2 Q 1964	1897.14	36.08	0.0167	0.0033
3 Q 1964	1941.63	35.94	0.0078	0.0033
4 Q 1964	1986.56	35.81	0.0090	0.0043
1 Q 1965	2041.63	35.74	0.0108	0.0011
2 Q 1965	2076.10	35.49	0.0101	0.0106
3 Q 1965	2103.97	35.33	-0.0025	0.0011
4 Q 1965	2102.14	35.18	-0.0113	0.0064
1 Q 1966	2118.58	49.76	-0.0066	0.0094
2 Q 1966	2121.49	49.26	-0.0137	0.0083

Table A-4 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bond Yields	Inflation Rates
3 Q 1966	2165.95	48.80	0.0082	0.0102
4 Q 1966	2309.59	48.44	0.0493	0.0051
1 Q 1967	2380.76	49.03	0.0126	0.0030
2 Q 1967	2261.58	48.70	-0.0631	0.0080
3 Q 1967	2282.47	48.18	-0.0022	0.0100
4 Q 1967	2217.45	47.79	-0.0408	0.0090
1 Q 1968	2260.65	52.35	0.0076	0.0117
2 Q 1968	2399.74	51.76	0.0507	0.0116
3 Q 1968	2468.58	51.13	0.0181	0.0106
4 Q 1968	2307.08	50.52	-0.0746	0.0123
1 Q 1969	2293.79	55.97	-0.0155	0.0150
2 Q 1969	2342.13	55.00	0.0128	0.0158
3 Q 1969	2244.17	54.23	-0.0522	0.0137
4 Q 1969	2273.70	53.49	0.0044	0.0153
1 Q 1970	2404.10	51.64	0.0493	0.0142
2 Q 1970	2318.97	50.82	-0.0418	0.0157
3 Q 1970	2468.37	50.26	0.0534	0.0102
4 Q 1970	2626.86	49.61	0.0584	0.0137
1 Q 1971	2895.43	54.63	0.0878	0.0059
2 Q 1971	2782.45	54.01	-0.0443	0.0142
3 Q 1971	3018.11	53.48	0.0717	0.0058
4 Q 1971	3098.45	53.20	0.0164	0.0073
1 Q 1972	3118.78	60.90	-0.0059	0.0073
2 Q 1972	3225.78	60.40	0.0231	0.0080
3 Q 1972	3306.18	59.86	0.0161	0.0096
4 Q 1972	3410.52	59.32	0.0226	0.0088
1 Q 1973	3343.53	74.55	-0.0228	0.0195
2 Q 1973	3324.78	72.94	-0.0080	0.0199
3 Q 1973	3403.35	71.37	0.0257	0.0235
4 Q 1973	3381.89	69.75	-0.0053	0.0221
1 Q 1974	3227.89	84.36	-0.0396	0.0333
2 Q 1974	3198.63	82.04	-0.0089	0.0265
3 Q 1974	3171.02	79.62	-0.0020	0.0326
4 Q 1974	3477.51	77.36	0.0984	0.0244
1 Q 1975	3534.21	81.16	0.0082	0.0154
2 Q 1975	3663.05	79.91	0.0319	0.0178
3 Q 1975	3583.82	78.23	-0.0251	0.0187
4 Q 1975	3872.37	77.01	0.0765	0.0165
1 Q 1976	4050.83	82.76	0.0321	0.0072
2 Q 1976	4076.99	62.05	0.0065	0.0155
3 Q 1976	4274.83	80.47	0.0440	0.0148
4 Q 1976	4636.92	79.57	0.0767	0.0099
1 Q 1977	4463.31	84.33	-0.0345	0.0224
2 Q 1977	4616.20	82.55	0.0363	0.0202
3 Q 1977	4686.88	81.37	0.0097	0.0120
4 Q 1977	4637.45	80.46	-0.0166	0.0114
1 Q 1978	4588.43	82.98	-0.0097	0.0193
2 Q 1978	4481.45	80.86	-0.0127	0.0295
3 Q 1978	4586.45	79.01	0.0254	0.0195
4 Q 1978	4513.24	77.47	-0.0144	0.0191
1 Q 1979	4562.41	98.98	0.0192	0.0306
2 Q 1979	4713.74	95.77	0.0461	0.0335
3 Q 1979	4542.88	92.65	-0.0239	0.0339
4 Q 1979	4280.89	90.02	-0.0507	0.0291
1 Q 1980	3610.97	102.28	-0.1451	0.0431
2 Q 1980	4448.01	98.71	0.2437	0.0325
3 Q 1980	3979.24	96.89	-0.1127	0.0166
4 Q 1980	4040.07	94.42	0.0180	0.0266
1 Q 1981	3977.42	109.68	-0.0178	0.0259

Table A-4 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bond Yields	Inflation Rates
2 Q 1981	3951.09	107.20	-0.0110	0.0234
3 Q 1981	3611.04	104.21	-0.0863	0.0295
4 Q 1981	4214.15	102.74	0.1476	0.0079
1 Q 1982	4495.14	108.21	0.0469	0.0057
2 Q 1982	4562.62	106.58	0.0175	0.0264
3 Q 1982	5537.58	104.60	0.2019	0.0093
4 Q 1982	6194.91	104.39	0.0964	-0.0031
1 Q 1983	6340.84	120.10	0.0076	0.0034
2 Q 1983	6351.61	118.62	-0.0012	0.0161
3 Q 1983	6398.56	117.21	0.0012	0.0123
4 Q 1983	6474.13	116.21	-0.0007	0.0057
1 Q 1984	6465.02	132.55	-0.0096	0.0125
2 Q 1984	6222.40	131.11	-0.0474	0.0110
3 Q 1984	7110.56	129.71	0.1356	0.0122
4 Q 1984	7764.98	128.78	0.0773	0.0031

^aContributions and their compounded values are expressed in January, 1937 dollars.

^bIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook (Chicago, 1987), p. 124.

^cIbid., p. 128.

Table A-5. Compounded Real Contributions (Expressed in January, 1937 Dollars) for Individuals Retiring in January of Each Year, 1940-1985, and When Compounding of Contributions Is at the Standard and Poor's 500 Composite Index Yields.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	196.64	147.48	98.32	49.16
1941	234.80	176.10	117.40	58.70
1942	239.37	179.53	119.69	59.84
1943	320.60	240.45	160.30	80.15
1944	438.92	329.19	219.46	109.73
1945	564.14	423.10	282.07	141.03
1946	804.91	603.68	402.46	201.23
1947	662.76	497.07	331.38	165.69
1948	679.43	509.57	339.71	169.86
1949	732.31	549.23	366.16	183.08
1950	925.43	694.07	462.71	231.36
1951	1209.12	906.84	604.56	302.28
1952	1478.21	1108.66	739.11	369.55
1953	1794.47	1345.86	897.24	448.62
1954	1823.52	1367.64	911.76	455.88
1955	2885.85	2164.39	1442.92	721.46
1956	3878.86	2909.14	1939.43	969.71
1957	4103.10	3077.32	2051.55	1025.77
1958	3629.59	2722.19	1814.80	907.40
1959	5207.53	3905.65	2603.77	1301.88
1960	5851.42	4388.57	2925.71	1462.86
1961	5921.73	4441.29	2960.86	1480.43
1962	7595.17	5696.38	3797.59	1898.79
1963	6982.10	5236.57	3491.05	1745.52
1964	8588.41	6441.31	4294.21	2147.10
1965	10036.15	7527.11	5018.07	2509.04
1966	11221.10	8415.83	5610.55	2805.28
1967	9958.32	7468.74	4979.16	2489.58
1968	12182.43	9136.82	6091.21	3045.61
1969	13137.87	9853.40	6568.94	3284.47
1970	11539.11	8654.33	5769.55	2884.78
1971	11600.78	8700.59	5800.39	2900.20
1972	13050.39	9787.79	6525.19	3262.60
1973	15269.27	11451.95	7634.64	3817.32
1974	12240.98	9180.74	6120.49	3060.25
1975	8308.00	6231.00	4154.00	2077.00
1976	10973.69	8230.27	5486.84	2743.42
1977	13276.60	9957.45	6638.30	3319.15
1978	11862.21	8896.66	5931.11	2965.55
1979	11913.32	8934.99	5956.66	2978.33
1980	12826.66	9619.99	6413.33	3206.66
1981	15552.84	11664.63	7776.42	3888.21
1982	13985.10	10488.82	6992.55	3496.27
1983	16852.30	12639.23	8426.15	4213.08
1984	20369.24	15276.93	10184.62	5092.31
1985	21368.39	16026.29	10684.19	5342.10

Table A-6. Maximum Real Quarterly Contributions Compounded at the Standard and Poor's 500 Composite Index Yields and the Associated Input Variables.^a

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total S & P 500 Yields ^b	Inflation Rates ^c
1 Q 1937	14.63	14.63	0.0507	0.0168
2 Q 1937	27.01	14.42	-0.1293	0.0117
3 Q 1937	38.27	14.25	-0.0963	0.0162
4 Q 1937	44.79	14.30	-0.2140	-0.0137
1 Q 1938	51.97	14.64	-0.1859	-0.0232
2 Q 1938	86.59	14.66	0.3840	0.0000
3 Q 1938	107.11	14.67	0.0676	-0.0000
4 Q 1938	132.10	14.77	0.0902	-0.0047
1 Q 1939	127.09	14.89	-0.1608	-0.0120
2 Q 1939	142.99	14.97	0.0049	-0.0024
3 Q 1939	184.94	14.87	0.2123	0.0193
4 Q 1939	196.64	14.78	-0.0260	-0.0095
1 Q 1940	209.29	14.80	-0.0086	0.0024
2 Q 1940	187.94	14.76	-0.1685	0.0048
3 Q 1940	218.89	14.77	0.0835	-0.0024
4 Q 1940	234.80	14.73	0.0102	0.0048
1 Q 1941	237.78	14.66	-0.0453	0.0047
2 Q 1941	246.55	14.32	0.0112	0.0354
3 Q 1941	265.16	13.88	0.0518	0.0320
4 Q 1941	239.37	13.45	-0.1292	0.0220
1 Q 1942	229.36	13.09	-0.0653	0.0346
2 Q 1942	251.22	12.76	0.0593	0.0189
3 Q 1942	280.90	12.59	0.0811	0.0122
4 Q 1942	320.60	12.34	0.1241	0.0243
1 Q 1943	389.59	12.17	0.1982	0.0178
2 Q 1943	426.30	11.84	0.0825	0.0176
3 Q 1943	436.72	11.94	-0.0111	-0.0075
4 Q 1943	438.92	11.88	-0.0185	0.0038
1 Q 1944	470.70	11.92	0.0413	-0.0038
2 Q 1944	522.03	11.81	0.0965	0.0115
3 Q 1944	526.36	11.69	-0.0047	0.0095
4 Q 1944	564.14	11.65	0.0536	0.0038
1 Q 1945	597.94	11.64	0.0373	-0.0019
2 Q 1945	663.40	11.53	0.1107	0.0188
3 Q 1945	736.40	11.43	0.0907	-0.0019
4 Q 1945	804.91	11.42	0.0855	0.0074
1 Q 1946	854.12	11.37	0.0509	0.0037
2 Q 1946	871.76	11.19	0.0297	0.0219
3 Q 1946	662.83	10.28	-0.1804	0.0949
4 Q 1946	662.76	9.75	0.0366	0.0522
1 Q 1947	660.81	9.57	0.0024	0.0202
2 Q 1947	679.41	9.43	0.0185	0.0046
3 Q 1947	663.70	9.17	0.0057	0.0440
4 Q 1947	679.43	8.92	0.0293	0.0189
1 Q 1948	686.93	8.79	-0.0019	-0.0000
2 Q 1948	760.54	8.64	0.1257	0.0284
3 Q 1948	709.85	8.46	-0.0624	0.0167
4 Q 1948	732.31	8.54	0.0016	-0.0177
1 Q 1949	752.70	8.66	0.0061	-0.0097
2 Q 1949	728.83	8.67	-0.0419	0.0014
3 Q 1949	822.80	8.70	0.1169	0.0000
4 Q 1949	925.43	8.73	0.1032	-0.0098
1 Q 1950	985.01	13.19	0.0473	-0.0027
2 Q 1950	1027.66	13.09	0.0416	0.0112
3 Q 1950	1134.75	12.79	0.1193	0.0252
4 Q 1950	1209.12	12.54	0.0790	0.0233
1 Q 1951	1260.61	14.53	0.0635	0.0320
2 Q 1951	1265.37	14.38	-0.0038	0.0039

Table A-6 (Continued)

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total S & P 500 Yields	Inflation Rates
3	Q	1951	1425.43	14.33	0.1238	0.0077
4	Q	1951	1478.21	14.13	0.0416	0.0141
1	Q	1952	1559.96	14.13	0.0392	-0.0063
2	Q	1952	1626.28	14.08	0.0414	0.0076
3	Q	1952	1619.15	13.94	-0.0055	0.0076
4	Q	1952	1794.47	13.93	0.0997	-0.0000
1	Q	1953	1752.01	14.02	-0.0363	-0.0050
2	Q	1953	1701.67	13.96	-0.0294	0.0076
3	Q	1953	1669.75	13.85	-0.0208	0.0062
4	Q	1953	1823.52	13.83	0.0812	-0.0024
1	Q	1954	2023.98	18.45	0.0999	0.0001
2	Q	1954	2237.43	18.47	0.0990	0.0024
3	Q	1954	2527.87	18.46	0.1174	-0.0037
4	Q	1954	2885.85	18.55	0.1300	-0.0038
1	Q	1955	2984.28	21.66	0.0266	0.0000
2	Q	1955	3403.54	21.66	0.1332	0.0000
3	Q	1955	3656.54	21.60	0.0732	0.0049
4	Q	1955	3878.86	21.56	0.0535	-0.0013
1	Q	1956	4197.33	21.61	0.0765	-0.0000
2	Q	1956	4079.22	21.44	-0.0212	0.0124
3	Q	1956	3963.73	21.17	-0.0264	0.0074
4	Q	1956	4103.10	21.02	0.0386	0.0085
1	Q	1957	3909.86	20.89	-0.0453	0.0072
2	Q	1957	4210.96	20.68	0.0846	0.0120
3	Q	1957	3800.42	20.47	-0.0960	0.0071
4	Q	1957	3629.59	20.39	-0.0470	0.0035
1	Q	1958	3826.55	20.19	0.0635	0.0142
2	Q	1958	4157.59	20.03	0.0851	0.0035
3	Q	1958	4662.22	20.01	0.1166	-0.0000
4	Q	1958	5207.53	20.01	0.1127	-0.0000
1	Q	1959	5297.04	25.72	0.0122	-0.0000
2	Q	1959	5616.25	25.65	0.0628	0.0070
3	Q	1959	5505.83	25.49	-0.0197	0.0046
4	Q	1959	5851.42	25.35	0.0618	0.0034
1	Q	1960	5484.90	31.00	-0.0679	-0.0000
2	Q	1960	5675.66	30.79	0.0374	0.0080
3	Q	1960	5405.98	30.73	-0.0519	0.0011
4	Q	1960	5921.73	30.55	0.0959	0.0056
1	Q	1961	6710.93	30.54	0.1281	0.0000
2	Q	1961	6739.59	30.53	0.0008	0.0011
3	Q	1961	6999.42	30.37	0.0398	0.0056
4	Q	1961	7595.17	30.34	0.0808	0.0000
1	Q	1962	7434.79	31.64	-0.0210	0.0044
2	Q	1962	5920.39	31.51	-0.2062	0.0022
3	Q	1962	6122.63	31.38	0.0368	0.0077
4	Q	1962	6982.10	31.31	0.1328	-0.0022
1	Q	1963	7437.25	36.71	0.0634	0.0033
2	Q	1963	7812.58	36.61	0.0501	0.0044
3	Q	1963	8133.50	36.34	0.0410	0.0044
4	Q	1963	8588.41	36.24	0.0561	0.0044
1	Q	1964	9135.31	36.16	0.0606	0.0011
2	Q	1964	9524.15	36.08	0.0420	0.0033
3	Q	1964	9887.55	35.94	0.0378	0.0033
4	Q	1964	10036.15	35.81	0.0158	0.0043
1	Q	1965	10300.52	35.74	0.0239	0.0011
2	Q	1965	10061.04	35.49	-0.0163	0.0106
3	Q	1965	10860.35	35.33	0.0771	0.0011
4	Q	1965	11221.10	35.18	0.0366	0.0064
1	Q	1966	10862.25	49.76	-0.0273	0.0094
2	Q	1966	10364.37	49.26	-0.0425	0.0083

Table A-6 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total S & P 500 Yields	Inflation Rates
3 Q 1966	9400.37	48.80	-0.0885	0.0102
4 Q 1966	9958.32	48.44	0.0596	0.0051
1 Q 1967	11288.66	49.03	0.1321	0.0030
2 Q 1967	11390.88	48.70	0.0128	0.0080
3 Q 1967	12172.01	48.18	0.0750	0.0100
4 Q 1967	12182.43	47.79	0.0059	0.0090
1 Q 1968	11404.21	52.35	-0.0572	0.0117
2 Q 1968	12591.84	51.76	0.1124	0.0116
3 Q 1968	12994.79	51.13	0.0389	0.0106
4 Q 1968	13137.87	50.52	0.0196	0.0123
1 Q 1969	12806.31	55.97	-0.0150	0.0150
2 Q 1969	12283.85	55.00	-0.0300	0.0158
3 Q 1969	11697.63	54.23	-0.0392	0.0137
4 Q 1969	11539.11	53.49	-0.0031	0.0153
1 Q 1970	11234.85	51.64	-0.0171	0.0142
2 Q 1970	9118.41	50.82	-0.1803	0.0157
3 Q 1970	10602.95	50.26	0.1691	0.0102
4 Q 1970	11600.78	49.61	0.1043	0.0137
1 Q 1971	12705.38	54.63	0.0970	0.0059
2 Q 1971	12603.42	54.01	0.0017	0.0142
3 Q 1971	12509.64	53.48	-0.0059	0.0058
4 Q 1971	13050.39	53.20	0.0466	0.0073
1 Q 1972	13760.71	60.90	0.0574	0.0073
2 Q 1972	13802.48	60.40	0.0067	0.0080
3 Q 1972	14265.05	59.86	0.0391	0.0096
4 Q 1972	15269.27	59.32	0.0756	0.0088
1 Q 1973	14319.75	74.55	-0.0489	0.0195
2 Q 1973	13303.01	72.94	-0.0577	0.0199
3 Q 1973	13694.22	71.37	0.0481	0.0235
4 Q 1973	12240.98	69.75	-0.0916	0.0221
1 Q 1974	11597.58	84.36	-0.0282	0.0333
2 Q 1974	10526.22	82.04	-0.0756	0.0265
3 Q 1974	7708.60	79.62	-0.2516	0.0326
4 Q 1974	8308.00	77.36	0.0938	0.0244
1 Q 1975	10140.29	81.16	0.2294	0.0154
2 Q 1975	11573.71	79.91	0.1537	0.0178
3 Q 1975	10194.88	78.23	-0.1095	0.0187
4 Q 1975	10973.69	77.01	0.0865	0.0165
1 Q 1976	12608.83	82.76	0.1497	0.0072
2 Q 1976	12787.13	62.05	0.0248	0.0155
3 Q 1976	12922.86	80.47	0.0192	0.0148
4 Q 1976	13276.60	79.57	0.0314	0.0099
1 Q 1977	12104.29	84.33	-0.0744	0.0224
2 Q 1977	12341.05	82.55	0.0332	0.0202
3 Q 1977	11931.65	81.37	-0.0282	0.0120
4 Q 1977	11862.21	80.46	-0.0013	0.0114
1 Q 1978	11147.73	82.98	-0.0492	0.0193
2 Q 1978	11830.13	80.86	0.0850	0.0295
3 Q 1978	12688.19	79.01	0.0867	0.0195
4 Q 1978	11913.32	77.47	-0.0493	0.0191
1 Q 1979	12476.05	98.98	0.0707	0.0306
2 Q 1979	12496.15	95.77	0.0272	0.0335
3 Q 1979	13090.09	92.65	0.0753	0.0339
4 Q 1979	12826.66	90.02	0.0013	0.0291
1 Q 1980	11897.73	102.28	-0.0408	0.0431
2 Q 1980	13166.80	98.71	0.1341	0.0325
3 Q 1980	14499.39	96.89	0.1120	0.0166
4 Q 1980	15552.84	94.42	0.0945	0.0266
1 Q 1981	15469.42	109.68	0.0132	0.0259
2 Q 1981	14873.90	107.20	-0.0231	0.0234

Table A-6 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total S & P 500 Yields	Inflation Rates
3 Q 1981	13075.71	104.21	-0.1022	0.0295
4 Q 1981	13985.10	102.74	0.0701	0.0079
1 Q 1982	13009.08	108.21	-0.0723	0.0057
2 Q 1982	12702.44	106.58	-0.0062	0.0264
3 Q 1982	14131.98	104.60	0.1146	0.0093
4 Q 1982	16852.30	104.39	0.1814	-0.0031
1 Q 1983	18602.45	120.10	0.1005	0.0034
2 Q 1983	20460.44	118.62	0.1111	0.0161
3 Q 1983	20299.07	117.21	-0.0014	0.0123
4 Q 1983	20369.24	116.21	0.0034	0.0057
1 Q 1984	19793.59	132.55	-0.0227	0.0125
2 Q 1984	19203.41	131.11	-0.0258	0.0110
3 Q 1984	20937.34	129.71	0.0968	0.0122
4 Q 1984	21368.39	128.78	0.0176	0.0031

^aContributions and their compounded values are expressed in January, 1937 dollars.

^bIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), p. 119.

^cIbid., p. 128.

Table A-7. Compounded Real Contributions (Expressed in January, 1937 Dollars) for Individuals Retiring in January of Each Year, 1940-1985, and When Compounding of Contributions Is at the Center for Research on Security Prices' Value-Weighted Index Yields.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	198.02	148.51	99.01	49.50
1941	240.27	180.20	120.14	60.07
1942	248.91	186.68	124.46	62.23
1943	321.59	241.20	160.80	80.40
1944	446.81	335.11	223.40	111.70
1945	580.94	435.71	290.47	145.24
1946	839.36	629.52	419.68	209.84
1947	703.66	527.75	351.83	175.92
1948	703.84	527.88	351.92	175.96
1949	734.98	551.24	367.49	183.75
1950	939.43	704.58	469.72	234.86
1951	1210.58	907.93	605.29	302.64
1952	1444.08	1083.06	722.04	361.02
1953	1681.27	1260.95	840.63	420.32
1954	1734.61	1300.96	867.31	433.65
1955	2712.05	2034.04	1356.03	678.01
1956	3479.11	2609.34	1739.56	869.78
1957	3759.26	2819.45	1879.63	939.82
1958	3334.52	2500.89	1667.26	833.63
1959	4821.15	3615.86	2410.58	1205.29
1960	5467.53	4100.65	2733.76	1366.88
1961	5549.00	4161.75	2774.50	1387.25
1962	7140.22	5355.16	3570.11	1785.05
1963	6525.71	4894.28	3262.85	1631.43
1964	7948.48	5961.36	3974.24	1987.12
1965	9287.80	6965.85	4643.90	2321.95
1966	10536.40	7902.30	5268.20	2634.10
1967	9482.94	7112.21	4741.47	2370.74
1968	11878.43	8908.82	5939.21	2969.61
1969	13015.02	9761.27	6507.51	3253.76
1970	11269.85	8452.39	5634.93	2817.46
1971	11044.12	8283.09	5522.06	2761.03
1972	12593.53	9445.15	6296.76	3148.38
1973	14609.34	10957.00	7304.67	3652.33
1974	11396.00	8547.00	5698.00	2849.00
1975	7723.39	5792.54	3861.69	1930.85
1976	10262.23	7696.68	5131.12	2565.56
1977	12680.45	9510.34	6340.23	3170.11
1978	11623.63	8717.73	5811.82	2905.91
1979	11797.13	8847.84	5898.56	2949.28
1980	13047.97	9785.98	6523.99	3261.99
1981	15856.62	11892.47	7928.31	3964.16
1982	14390.22	10792.67	7195.11	3597.56
1983	17233.10	12924.83	8616.55	4308.28
1984	20875.74	15656.80	10437.87	5218.93
1985	21652.75	16239.56	10826.37	5413.19

Table A-8. Maximum Real Quarterly Contributions Compounded at the Center for Research on Security Prices' Value-Weighted Index Yields and the Associated Input Variables.

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total CRSP Index ^b Yields ^b	Inflation Rates ^c
1	Q	1937	14.63	14.63	0.0420	0.0168
2	Q	1937	27.14	14.42	-0.1204	0.0117
3	Q	1937	38.21	14.25	-0.1029	0.0162
4	Q	1937	45.17	14.30	-0.2030	-0.0137
1	Q	1938	52.29	14.64	-0.1857	-0.0232
2	Q	1938	85.64	14.66	0.3573	0.0000
3	Q	1938	104.66	14.67	0.0508	-0.0000
4	Q	1938	130.35	14.77	0.0991	-0.0047
1	Q	1939	127.97	14.89	-0.1428	-0.0120
2	Q	1939	144.47	14.97	0.0095	-0.0024
3	Q	1939	183.51	14.87	0.1898	0.0193
4	Q	1939	198.02	14.78	-0.0109	-0.0095
1	Q	1940	213.60	14.80	0.0063	0.0024
2	Q	1940	191.28	14.76	-0.1696	0.0048
3	Q	1940	222.05	14.77	0.0810	-0.0024
4	Q	1940	240.27	14.73	0.0206	0.0048
1	Q	1941	242.93	14.66	-0.0455	0.0047
2	Q	1941	252.76	14.32	0.0163	0.0354
3	Q	1941	271.40	13.88	0.0514	0.0320
4	Q	1941	248.91	13.45	-0.1133	0.0220
1	Q	1942	234.16	13.09	-0.0811	0.0346
2	Q	1942	252.05	12.76	0.0412	0.0189
3	Q	1942	282.00	12.59	0.0820	0.0122
4	Q	1942	321.59	12.34	0.1233	0.0243
1	Q	1943	394.53	12.17	0.2102	0.0178
2	Q	1943	431.09	11.84	0.0813	0.0176
3	Q	1943	441.82	11.94	-0.0103	-0.0075
4	Q	1943	446.81	11.88	-0.0119	0.0038
1	Q	1944	481.30	11.92	0.0465	-0.0038
2	Q	1944	532.18	11.81	0.0937	0.0115
3	Q	1944	538.84	11.69	-0.0000	0.0095
4	Q	1944	580.94	11.65	0.0605	0.0038
1	Q	1945	618.36	11.64	0.0424	-0.0019
2	Q	1945	680.24	11.53	0.1018	0.0188
3	Q	1945	751.92	11.43	0.0865	-0.0019
4	Q	1945	839.36	11.42	0.1093	0.0074
1	Q	1946	897.62	11.37	0.0597	0.0037
2	Q	1946	925.82	11.19	0.0413	0.0219
3	Q	1946	703.21	10.28	-0.1806	0.0949
4	Q	1946	703.66	9.75	0.0383	0.0522
1	Q	1947	690.41	9.57	-0.0129	0.0202
2	Q	1947	691.24	9.43	-0.0079	0.0046
3	Q	1947	683.38	9.17	0.0182	0.0440
4	Q	1947	703.84	8.92	0.0361	0.0189
1	Q	1948	710.67	8.79	-0.0028	-0.0000
2	Q	1948	778.83	8.64	0.1146	0.0284
3	Q	1948	717.05	8.46	-0.0750	0.0167
4	Q	1948	734.98	8.54	-0.0048	-0.0177
1	Q	1949	761.07	8.66	0.0138	-0.0097
2	Q	1949	736.93	8.67	-0.0418	0.0014
3	Q	1949	832.90	8.70	0.1184	0.0000
4	Q	1949	939.43	8.73	0.1065	-0.0098
1	Q	1950	996.49	13.19	0.0438	-0.0027
2	Q	1950	1021.78	13.09	0.0236	0.0112
3	Q	1950	1128.21	12.79	0.1192	0.0252
4	Q	1950	1210.58	12.54	0.0866	0.0233
1	Q	1951	1247.73	14.53	0.0513	0.0320
2	Q	1951	1257.95	14.38	0.0006	0.0039

Table A-8 (Continued)

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total CRSP Index Yields	Inflation Rates
3	Q	1951	1424.33	14.33	0.1295	0.0077
4	Q	1951	1444.08	14.13	0.0181	0.0141
1	Q	1952	1520.23	14.13	0.0364	-0.0063
2	Q	1952	1554.99	14.08	0.0213	0.0076
3	Q	1952	1535.31	13.94	-0.0142	0.0076
4	Q	1952	1681.27	13.93	0.0860	-0.0000
1	Q	1953	1675.84	14.02	-0.0165	-0.0050
2	Q	1953	1615.90	13.96	-0.0368	0.0076
3	Q	1953	1593.16	13.85	-0.0166	0.0062
4	Q	1953	1734.61	13.83	0.0775	-0.0024
1	Q	1954	1946.28	18.45	0.1115	0.0001
2	Q	1954	2130.15	18.47	0.0876	0.0024
3	Q	1954	2356.23	18.46	0.0934	-0.0037
4	Q	1954	2712.05	18.55	0.1388	-0.0038
1	Q	1955	2837.64	21.66	0.0383	0.0000
2	Q	1955	3177.61	21.66	0.1122	0.0000
3	Q	1955	3254.54	21.60	0.0224	0.0049
4	Q	1955	3479.11	21.56	0.0610	-0.0013
1	Q	1956	3778.73	21.61	0.0799	-0.0000
2	Q	1956	3722.37	21.44	-0.0084	0.0124
3	Q	1956	3605.66	21.17	-0.0299	0.0074
4	Q	1956	3759.26	21.02	0.0456	0.0085
1	Q	1957	3657.18	20.89	-0.0257	0.0072
2	Q	1957	3919.66	20.68	0.0790	0.0120
3	Q	1957	3534.44	20.47	-0.0971	0.0071
4	Q	1957	3334.52	20.39	-0.0591	0.0035
1	Q	1958	3536.25	20.19	0.0694	0.0142
2	Q	1958	3851.31	20.03	0.0872	0.0035
3	Q	1958	4315.08	20.01	0.1152	-0.0000
4	Q	1958	4821.15	20.01	0.1126	-0.0000
1	Q	1959	4961.59	25.72	0.0238	-0.0000
2	Q	1959	5248.78	25.65	0.0601	0.0070
3	Q	1959	5128.78	25.49	-0.0232	0.0046
4	Q	1959	5467.53	25.35	0.0647	0.0034
1	Q	1960	5133.44	31.00	-0.0668	-0.0000
2	Q	1960	5323.42	30.79	0.0393	0.0080
3	Q	1960	5085.25	30.73	-0.0495	0.0011
4	Q	1960	5549.00	30.55	0.0913	0.0056
1	Q	1961	6352.53	30.54	0.1393	0.0000
2	Q	1961	6380.85	30.53	0.0008	0.0011
3	Q	1961	6611.31	30.37	0.0371	0.0056
4	Q	1961	7140.22	30.34	0.0754	0.0000
1	Q	1962	6982.01	31.64	-0.0223	0.0044
2	Q	1962	5536.93	31.51	-0.2097	0.0022
3	Q	1962	5729.14	31.38	0.0370	0.0077
4	Q	1962	6525.71	31.31	0.1311	-0.0022
1	Q	1963	6949.67	36.71	0.0628	0.0033
2	Q	1963	7301.01	36.61	0.0499	0.0044
3	Q	1963	7586.61	36.34	0.0387	0.0044
4	Q	1963	7948.48	36.24	0.0475	0.0044
1	Q	1964	8469.79	36.16	0.0622	0.0011
2	Q	1964	8799.45	36.08	0.0381	0.0033
3	Q	1964	9147.35	35.94	0.0389	0.0033
4	Q	1964	9287.80	35.81	0.0158	0.0043
1	Q	1965	9624.99	35.74	0.0336	0.0011
2	Q	1965	9346.56	35.49	-0.0223	0.0106
3	Q	1965	10132.03	35.33	0.0814	0.0011
4	Q	1965	10536.40	35.18	0.0431	0.0064
1	Q	1966	10261.25	49.76	-0.0217	0.0094
2	Q	1966	9825.97	49.26	-0.0393	0.0083

Table A-8 (Continued)

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total CRSP Index Yields	Inflation Rates
3	Q	1966	8880.94	48.80	-0.0919	0.0102
4	Q	1966	9482.94	48.44	0.0678	0.0051
1	Q	1967	10836.95	49.03	0.1410	0.0030
2	Q	1967	11039.56	48.70	0.0223	0.0080
3	Q	1967	11818.72	48.18	0.0769	0.0100
4	Q	1967	11878.43	47.79	0.0100	0.0090
1	Q	1968	11060.14	52.35	-0.0624	0.0117
2	Q	1968	12387.27	51.76	0.1283	0.0116
3	Q	1968	12753.15	51.13	0.0363	0.0106
4	Q	1968	13015.02	50.52	0.0291	0.0123
1	Q	1969	12526.23	55.97	-0.0275	0.0150
2	Q	1969	11898.40	55.00	-0.0396	0.0158
3	Q	1969	11346.11	54.23	-0.0380	0.0137
4	Q	1969	11269.85	53.49	0.0037	0.0153
1	Q	1970	10898.46	51.64	-0.0239	0.0142
2	Q	1970	8661.31	50.82	-0.1975	0.0157
3	Q	1970	10136.24	50.26	0.1764	0.0102
4	Q	1970	11044.12	49.61	0.0995	0.0137
1	Q	1971	12261.29	54.63	0.1118	0.0059
2	Q	1971	12151.07	54.01	0.0006	0.0142
3	Q	1971	12061.06	53.48	-0.0061	0.0058
4	Q	1971	12593.53	53.20	0.0473	0.0073
1	Q	1972	13384.70	60.90	0.0657	0.0073
2	Q	1972	13358.41	60.40	0.0015	0.0080
3	Q	1972	13677.44	59.86	0.0292	0.0096
4	Q	1972	14609.34	59.32	0.0732	0.0088
1	Q	1973	13408.22	74.55	-0.0695	0.0195
2	Q	1973	12273.13	72.94	-0.0720	0.0199
3	Q	1973	12930.19	71.37	0.0723	0.0235
4	Q	1973	11396.00	69.75	-0.1047	0.0221
1	Q	1974	10877.40	84.36	-0.0214	0.0333
2	Q	1974	9680.35	82.04	-0.0942	0.0265
3	Q	1974	7155.48	79.62	-0.2452	0.0326
4	Q	1974	7723.39	77.36	0.0946	0.0244
1	Q	1975	9507.22	81.16	0.2392	0.0154
2	Q	1975	10926.01	79.91	0.1611	0.0178
3	Q	1975	9554.21	78.23	-0.1165	0.0187
4	Q	1975	10262.23	77.01	0.0836	0.0165
1	Q	1976	11897.69	82.76	0.1596	0.0072
2	Q	1976	12093.85	62.05	0.0269	0.0155
3	Q	1976	12217.79	80.47	0.0184	0.0148
4	Q	1976	12680.45	79.57	0.0416	0.0099
1	Q	1977	11669.45	84.33	-0.0660	0.0224
2	Q	1977	12002.33	82.55	0.0421	0.0202
3	Q	1977	11600.94	81.37	-0.0287	0.0120
4	Q	1977	11623.63	80.46	0.0064	0.0114
1	Q	1978	11059.31	82.98	-0.0374	0.0193
2	Q	1978	11783.42	80.86	0.0894	0.0295
3	Q	1978	12676.38	79.01	0.0899	0.0195
4	Q	1978	11797.13	77.47	-0.0578	0.0191
1	Q	1979	12443.72	98.98	0.0784	0.0306
2	Q	1979	12569.80	95.77	0.0360	0.0335
3	Q	1979	13210.17	92.65	0.0789	0.0339
4	Q	1979	13047.97	90.02	0.0094	0.0291
1	Q	1980	11913.39	102.28	-0.0558	0.0431
2	Q	1980	13341.92	98.71	0.1478	0.0325
3	Q	1980	14821.57	96.89	0.1219	0.0166
4	Q	1980	15856.62	94.42	0.0918	0.0266
1	Q	1981	15824.03	109.68	0.0167	0.0259
2	Q	1981	15352.05	107.20	-0.0141	0.0234

Table A-8 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total CRSP Index Yields	Inflation Rates
3 Q 1981	13390.30	104.21	-0.1091	0.0295
4 Q 1981	14390.22	102.74	0.0755	0.0079
1 Q 1982	13271.59	108.21	-0.0800	0.0057
2 Q 1982	12928.80	106.58	-0.0083	0.0264
3 Q 1982	14367.53	104.60	0.1135	0.0093
4 Q 1982	17233.10	104.39	0.1885	-0.0031
1 Q 1983	19006.62	120.10	0.0997	0.0034
2 Q 1983	21030.75	118.62	0.1179	0.0161
3 Q 1983	20875.66	117.21	-0.0008	0.0123
4 Q 1983	20875.74	116.21	0.0001	0.0057
1 Q 1984	20160.72	132.55	-0.0286	0.0125
2 Q 1984	19545.71	131.11	-0.0264	0.0110
3 Q 1984	21265.51	129.71	0.0946	0.0122
4 Q 1984	21652.75	128.78	0.0153	0.0031

^aContributions and their compounded values are expressed in January, 1937 dollars.

^bSource: The University of Tennessee's Computer Files, generated May 15, 1986.

^cIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), p. 128.

Table A-9. Compounded Real Contributions (Expressed in January, 1937 Dollars) for Individuals Retiring in January of Each Year, 1940-1985, and When Compounding of Contributions Is at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and in the Standard and Poor's 500 Composite Index.

Year of Retirement	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1940	187.41	140.55	93.70	46.85
1941	235.05	176.29	117.53	58.76
1942	253.98	190.49	126.99	63.50
1943	308.21	231.16	154.11	77.05
1944	387.18	290.38	193.59	96.79
1945	470.17	352.63	235.09	117.54
1946	609.84	457.38	304.92	152.46
1947	526.99	395.25	263.50	131.75
1948	537.97	403.48	268.99	134.49
1949	577.98	433.49	288.99	144.50
1950	698.42	523.82	349.21	174.61
1951	855.17	641.37	427.58	213.79
1952	1007.75	755.81	503.88	251.94
1953	1195.98	896.98	597.99	298.99
1954	1241.93	931.45	620.97	310.48
1955	1814.86	1361.15	907.43	453.72
1956	2359.34	1769.50	1179.67	589.83
1957	2512.31	1884.24	1256.16	628.08
1958	2317.50	1738.13	1158.75	579.38
1959	3145.60	2359.20	1572.80	786.40
1960	3526.73	2645.05	1763.37	881.68
1961	3630.56	2722.92	1815.28	907.64
1962	4538.10	3403.58	2269.05	1134.53
1963	4306.00	3229.50	2153.00	1076.50
1964	5194.15	3895.62	2597.08	1298.54
1965	6011.19	4508.39	3005.59	1502.80
1966	6694.34	5020.75	3347.17	1673.58
1967	6176.47	4632.35	3088.24	1544.12
1968	7398.96	5549.22	3699.48	1849.74
1969	7986.06	5989.55	3993.03	1996.52
1970	7302.60	5476.95	3651.30	1825.65
1971	7449.93	5587.45	3724.97	1862.48
1972	8299.31	6224.48	4149.65	2074.83
1973	9536.34	7152.26	4768.17	2384.09
1974	8133.49	6100.11	4066.74	2033.37
1975	6251.54	4688.66	3125.77	1562.89
1976	7718.02	5788.51	3859.01	1929.50
1977	9027.50	6770.62	4513.75	2256.87
1978	8448.04	6336.03	4224.02	2112.01
1979	8590.99	6443.25	4295.50	2147.75
1980	9166.66	6874.99	4583.33	2291.66
1981	10698.64	8023.98	5349.32	2674.66
1982	10287.06	7715.30	5143.53	2571.77
1983	12149.47	9112.10	6074.74	3037.37
1984	14327.55	10745.66	7163.77	3581.89
1985	15329.57	11497.18	7664.79	3832.39

Table A-10. Maximum Real Quarterly Contributions Compounded at the Yields on a Composite Portfolio Consisting of Equal Investments in Treasury Bills and in the Standard and Poor's 500 Composite Index and the Associated Input Variables.

Quarter of Compounding			Compounded Value	Maximum Real Contributions	Total Treasury Bill ^b Yields	Total S & P 500 Yields ^c	Inflation Rates ^d
1	Q	1937	14.63	14.63	0.0004	0.0507	0.0168
2	Q	1937	27.95	14.42	0.0012	-0.1293	0.0117
3	Q	1937	40.49	14.25	0.0009	-0.0963	0.0162
4	Q	1937	51.21	14.30	0.0004	-0.2140	-0.0137
1	Q	1938	62.80	14.64	-0.0001	-0.1859	-0.0232
2	Q	1938	87.44	14.66	0.0001	0.3840	0.0000
3	Q	1938	105.04	14.67	0.0001	0.0676	-0.0000
4	Q	1938	125.14	14.77	-0.0005	0.0902	-0.0047
1	Q	1939	130.79	14.89	-0.0001	-0.1608	-0.0120
2	Q	1939	146.40	14.97	0.0002	0.0049	-0.0024
3	Q	1939	173.39	14.87	-0.0000	0.2123	0.0193
4	Q	1939	187.41	14.78	0.0000	-0.0260	-0.0095
1	Q	1940	200.92	14.80	0.0000	-0.0086	0.0024
2	Q	1940	197.15	14.76	-0.0002	-0.1685	0.0048
3	Q	1940	220.26	14.77	-0.0000	0.0835	-0.0024
4	Q	1940	235.05	14.73	0.0000	0.0102	0.0048
1	Q	1941	243.31	14.66	-0.0001	-0.0453	0.0047
2	Q	1941	250.59	14.32	-0.0001	0.0112	0.0354
3	Q	1941	262.95	13.88	0.0005	0.0518	0.0320
4	Q	1941	253.98	13.45	0.0001	-0.1292	0.0220
1	Q	1942	251.08	13.09	0.0004	-0.0653	0.0346
2	Q	1942	265.94	12.76	0.0006	0.0593	0.0189
3	Q	1942	285.51	12.59	0.0009	0.0811	0.0122
4	Q	1942	308.21	12.34	0.0009	0.1241	0.0243
1	Q	1943	346.33	12.17	0.0009	0.1982	0.0178
2	Q	1943	368.12	11.84	0.0008	0.0825	0.0176
3	Q	1943	380.60	11.94	0.0009	-0.0111	-0.0075
4	Q	1943	387.18	11.88	0.0009	-0.0185	-0.0038
1	Q	1944	409.80	11.92	0.0008	0.0413	-0.0038
2	Q	1944	439.53	11.81	0.0009	0.0965	0.0115
3	Q	1944	446.00	11.69	0.0008	-0.0047	0.0095
4	Q	1944	470.17	11.65	0.0008	0.0536	0.0038
1	Q	1945	493.38	11.64	0.0007	0.0373	-0.0019
2	Q	1945	528.45	11.53	0.0008	0.1107	0.0188
3	Q	1945	571.21	11.43	0.0009	0.0907	-0.0019
4	Q	1945	609.84	11.42	0.0008	0.0855	0.0074
1	Q	1946	639.56	11.37	0.0009	0.0509	0.0037
2	Q	1946	649.60	11.19	0.0009	0.0297	0.0219
3	Q	1946	531.93	10.28	0.0009	-0.1804	0.0949
4	Q	1946	526.99	9.75	0.0009	0.0366	0.0522
1	Q	1947	527.11	9.57	0.0009	0.0024	0.0202
2	Q	1947	540.40	9.43	0.0009	0.0185	0.0046
3	Q	1947	528.91	9.17	0.0012	0.0057	0.0440
4	Q	1947	537.97	8.92	0.0020	0.0293	0.0189
1	Q	1948	546.58	8.79	0.0023	-0.0019	-0.0000
2	Q	1948	582.58	8.64	0.0025	0.1257	0.0284
3	Q	1948	558.57	8.46	0.0021	-0.0624	0.0167
4	Q	1948	577.98	8.54	0.0012	0.0016	-0.0177
1	Q	1949	595.21	8.66	0.0029	0.0061	-0.0097
2	Q	1949	587.94	8.67	0.0029	-0.0419	0.0014
3	Q	1949	639.89	8.70	0.0027	0.1169	0.0000
4	Q	1949	698.42	8.73	0.0026	0.1032	-0.0098
1	Q	1950	736.11	13.19	0.0028	0.0473	-0.0027
2	Q	1950	761.97	13.09	0.0029	0.0416	0.0112
3	Q	1950	816.54	12.79	0.0030	0.1193	0.0252
4	Q	1950	855.17	12.54	0.0034	0.0790	0.0233

Table A-10 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Total S & P 500 Yields	Inflation Rates
1 Q 1951	881.23	14.53	0.0034	0.0635	0.0320
2 Q 1951	890.75	14.38	0.0037	-0.0038	0.0039
3 Q 1951	976.94	14.33	0.0038	0.1238	0.0077
4 Q 1951	1007.75	14.13	0.0039	0.0416	0.0141
1 Q 1952	1058.42	14.13	0.0038	0.0392	-0.0063
2 Q 1952	1097.63	14.08	0.0040	0.0414	0.0076
3 Q 1952	1100.18	13.94	0.0046	-0.0055	0.0076
4 Q 1952	1195.98	13.93	0.0040	0.0997	-0.0000
1 Q 1953	1184.70	14.02	0.0048	-0.0363	-0.0050
2 Q 1953	1165.74	13.96	0.0051	-0.0294	0.0076
3 Q 1953	1156.26	13.85	0.0048	-0.0208	0.0062
4 Q 1953	1241.93	13.83	0.0034	0.0812	-0.0024
1 Q 1954	1352.22	18.45	0.0026	0.0999	0.0001
2 Q 1954	1468.05	18.47	0.0020	0.0990	0.0024
3 Q 1954	1624.46	18.46	0.0019	0.1174	-0.0037
4 Q 1954	1814.86	18.55	0.0021	0.1300	-0.0038
1 Q 1955	1875.91	21.66	0.0027	0.0266	0.0000
2 Q 1955	2097.68	21.66	0.0034	0.1332	0.0000
3 Q 1955	2234.71	21.60	0.0042	0.0732	0.0049
4 Q 1955	2359.34	21.56	0.0053	0.0535	-0.0013
1 Q 1956	2531.73	21.61	0.0056	0.0765	-0.0000
2 Q 1956	2480.73	21.44	0.0062	-0.0212	0.0124
3 Q 1956	2432.84	21.17	0.0057	-0.0264	0.0074
4 Q 1956	2512.31	21.02	0.0069	0.0386	0.0085
1 Q 1957	2426.24	20.89	0.0074	-0.0453	0.0072
2 Q 1957	2585.02	20.68	0.0075	0.0846	0.0120
3 Q 1957	2390.46	20.47	0.0081	-0.0960	0.0071
4 Q 1957	2317.50	20.39	0.0081	-0.0470	0.0035
1 Q 1958	2421.49	20.19	0.0049	0.0635	0.0142
2 Q 1958	2596.36	20.03	0.0022	0.0851	0.0035
3 Q 1958	2860.23	20.01	0.0030	0.1166	-0.0000
4 Q 1958	3145.60	20.01	0.0051	0.1127	-0.0000
1 Q 1959	3206.58	25.72	0.0062	0.0122	-0.0000
2 Q 1959	3378.79	25.65	0.0066	0.0628	0.0070
3 Q 1959	3337.98	25.49	0.0075	-0.0197	0.0046
4 Q 1959	3526.73	25.35	0.0090	0.0618	0.0034
1 Q 1960	3364.82	31.00	0.0097	-0.0679	-0.0000
2 Q 1960	3474.98	30.79	0.0070	0.0374	0.0080
3 Q 1960	3357.74	30.73	0.0046	-0.0519	0.0011
4 Q 1960	3630.56	30.55	0.0051	0.0959	0.0056
1 Q 1961	4043.99	30.54	0.0053	0.1281	0.0000
2 Q 1961	4076.61	30.53	0.0055	0.0008	0.0011
3 Q 1961	4221.23	30.37	0.0049	0.0398	0.0056
4 Q 1961	4538.10	30.34	0.0053	0.0808	0.0000
1 Q 1962	4475.21	31.64	0.0064	-0.0210	0.0044
2 Q 1962	3737.11	31.51	0.0066	-0.2062	0.0022
3 Q 1962	3853.46	31.38	0.0071	0.0368	0.0077
4 Q 1962	4306.00	31.31	0.0068	0.1328	-0.0022
1 Q 1963	4555.03	36.71	0.0071	0.0634	0.0033
2 Q 1963	4763.34	36.61	0.0072	0.0501	0.0044
3 Q 1963	4944.98	36.34	0.0079	0.0410	0.0044
4 Q 1963	5194.15	36.24	0.0085	0.0561	0.0044
1 Q 1964	5492.54	36.16	0.0087	0.0606	0.0011
2 Q 1964	5709.82	36.08	0.0085	0.0420	0.0033
3 Q 1964	5914.52	35.94	0.0086	0.0378	0.0033
4 Q 1964	6011.19	35.81	0.0089	0.0158	0.0043
1 Q 1965	6169.51	35.74	0.0094	0.0239	0.0011
2 Q 1965	6066.60	35.49	0.0097	-0.0163	0.0106
3 Q 1965	6492.65	35.33	0.0095	0.0771	0.0011
4 Q 1965	6694.34	35.18	0.0099	0.0366	0.0064

Table A-10 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Total S & P 500 Yields	Inflation Rates
1 Q 1966	6541.64	49.76	0.0111	-0.0273	0.0094
2 Q 1966	6320.66	49.26	0.0113	-0.0425	0.0083
3 Q 1966	5864.65	48.80	0.0116	-0.0885	0.0102
4 Q 1966	6176.47	48.44	0.0126	0.0596	0.0051
1 Q 1967	6876.71	49.03	0.0118	0.1321	0.0030
2 Q 1967	6953.65	48.70	0.0092	0.0128	0.0080
3 Q 1967	7367.56	48.18	0.0094	0.0750	0.0100
4 Q 1967	7398.96	47.79	0.0108	0.0059	0.0090
1 Q 1968	7036.03	52.35	0.0117	-0.0572	0.0117
2 Q 1968	7657.72	51.76	0.0132	0.1124	0.0116
3 Q 1968	7888.43	51.13	0.0134	0.0389	0.0106
4 Q 1968	7986.06	50.52	0.0130	0.0196	0.0123
1 Q 1969	7847.71	55.97	0.0146	-0.0150	0.0150
2 Q 1969	7613.27	55.00	0.0153	-0.0300	0.0158
3 Q 1969	7351.52	54.23	0.0166	-0.0392	0.0137
4 Q 1969	7302.60	53.49	0.0177	-0.0031	0.0153
1 Q 1970	7182.11	51.64	0.0180	-0.0171	0.0142
2 Q 1970	6150.07	50.82	0.0162	-0.1803	0.0157
3 Q 1970	6926.53	50.26	0.0160	0.1691	0.0102
4 Q 1970	7449.93	49.61	0.0135	0.1043	0.0137
1 Q 1971	8036.47	54.63	0.0101	0.0970	0.0059
2 Q 1971	8004.63	54.01	0.0094	0.0017	0.0142
3 Q 1971	7995.72	53.48	0.0125	-0.0059	0.0058
4 Q 1971	8299.31	53.20	0.0111	0.0466	0.0073
1 Q 1972	8686.34	60.90	0.0081	0.0574	0.0073
2 Q 1972	8738.87	60.40	0.0088	0.0067	0.0080
3 Q 1972	8999.73	59.86	0.0094	0.0391	0.0096
4 Q 1972	9536.34	59.32	0.0114	0.0756	0.0088
1 Q 1973	9086.99	74.55	0.0132	-0.0489	0.0195
2 Q 1973	8606.68	72.94	0.0155	-0.0577	0.0199
3 Q 1973	8831.92	71.37	0.0203	0.0481	0.0235
4 Q 1973	8133.49	69.75	0.0186	-0.0916	0.0221
1 Q 1974	7823.86	84.36	0.0178	-0.0282	0.0333
2 Q 1974	7318.59	82.04	0.0211	-0.0756	0.0265
3 Q 1974	5926.91	79.62	0.0212	-0.2516	0.0326
4 Q 1974	6251.54	77.36	0.0176	0.0938	0.0244
1 Q 1975	7205.98	81.16	0.0143	0.2294	0.0154
2 Q 1975	7952.48	79.91	0.0130	0.1537	0.0178
3 Q 1975	7294.26	78.23	0.0150	-0.1095	0.0187
4 Q 1975	7718.02	77.01	0.0146	0.0865	0.0165
1 Q 1976	8587.89	82.76	0.0121	0.1497	0.0072
2 Q 1976	8700.80	62.05	0.0122	0.0248	0.0155
3 Q 1976	8805.69	80.47	0.0134	0.0192	0.0148
4 Q 1976	9027.50	79.57	0.0121	-0.0314	0.0099
1 Q 1977	8456.82	84.33	0.0109	-0.0744	0.0224
2 Q 1977	8596.00	82.55	0.0115	0.0332	0.0202
3 Q 1977	8434.16	81.37	0.0130	-0.0282	0.0120
4 Q 1977	8448.04	80.46	0.0149	-0.0013	0.0114
1 Q 1978	8121.31	82.98	0.0149	-0.0492	0.0193
2 Q 1978	8469.53	80.86	0.0160	0.0850	0.0295
3 Q 1978	8932.99	79.01	0.0175	0.0867	0.0195
4 Q 1978	8590.99	77.47	0.0218	-0.0493	0.0191
1 Q 1979	8903.12	98.98	0.0233	0.0707	0.0306
2 Q 1979	8937.93	95.77	0.0245	0.0272	0.0335
3 Q 1979	9255.24	92.65	0.0239	0.0753	0.0339
4 Q 1979	9166.66	90.02	0.0284	0.0013	0.0291
1 Q 1980	8716.83	102.28	0.0293	-0.0408	0.0431
2 Q 1980	9385.93	98.71	0.0270	0.1341	0.0325
3 Q 1980	10108.26	96.89	0.0193	0.1120	0.0166
4 Q 1980	10698.64	94.42	0.0325	0.0945	0.0266

Table A-10 (Continued)

Quarter of Compounding	Compounded Value	Maximum Real Contributions	Total Treasury Bill Yields	Total S & P 500 Yields	Inflation Rates
1 Q 1981	10733.56	109.68	0.0336	0.0132	0.0259
2 Q 1981	10527.05	107.20	0.0362	-0.0231	0.0234
3 Q 1981	9705.86	104.21	0.0381	-0.1022	0.0295
4 Q 1981	10287.06	102.74	0.0318	-0.0701	0.0079
1 Q 1982	9923.72	108.21	0.0272	-0.0723	0.0057
2 Q 1982	9841.74	106.58	0.0318	-0.0062	0.0264
3 Q 1982	10657.40	104.60	0.0234	0.1146	0.0093
4 Q 1982	12149.47	104.39	0.0190	0.1814	-0.0031
1 Q 1983	13144.42	120.10	0.0195	0.1005	0.0034
2 Q 1983	14150.73	118.62	0.0208	0.1111	0.0161
3 Q 1983	14169.01	117.21	0.0228	-0.0014	0.0123
4 Q 1983	14327.55	116.21	0.0221	0.0034	0.0057
1 Q 1984	14145.33	132.55	0.0222	-0.0227	0.0125
2 Q 1984	13968.50	131.11	0.0236	-0.0258	0.0110
3 Q 1984	14956.67	129.71	0.0253	0.0968	0.0122
4 Q 1984	15329.57	128.78	0.0239	0.0176	0.0031

^aContributions and their compounded values are expressed in January, 1937 dollars.

^bIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), p. 127.

^cIbid., p. 119.

^dIbid., p. 128.

Table A-11. Quarterly Real Net Investment Amounts
(Expressed in January, 1937 Dollars) 1937-1984.

Quarter of Investment			Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1	Q	1937	14.63	10.97	7.31	3.66
2	Q	1937	14.42	10.82	7.21	3.61
3	Q	1937	14.25	10.69	7.12	3.56
4	Q	1937	14.30	10.72	7.15	3.57
1	Q	1938	14.64	10.98	7.32	3.66
2	Q	1938	14.66	10.99	7.33	3.66
3	Q	1938	14.67	11.00	7.34	3.67
4	Q	1938	14.77	11.08	7.39	3.69
1	Q	1939	14.89	11.16	7.44	3.72
2	Q	1939	14.97	11.23	7.49	3.74
3	Q	1939	14.87	11.16	7.44	3.72
4	Q	1939	14.78	11.09	7.39	3.70
1	Q	1940	14.80	11.10	7.40	3.70
2	Q	1940	14.76	11.07	7.38	3.69
3	Q	1940	14.77	11.08	7.39	3.69
4	Q	1940	14.73	11.05	7.37	3.68
1	Q	1941	14.66	10.99	7.33	3.66
2	Q	1941	14.32	10.74	7.16	3.58
3	Q	1941	13.88	10.41	6.94	3.47
4	Q	1941	13.45	10.09	6.72	3.36
1	Q	1942	13.09	9.81	6.54	3.27
2	Q	1942	12.76	9.57	6.38	3.19
3	Q	1942	12.59	9.44	6.30	3.15
4	Q	1942	12.34	9.25	6.17	3.08
1	Q	1943	12.17	9.13	6.09	3.04
2	Q	1943	11.84	8.88	5.92	2.96
3	Q	1943	11.94	8.95	5.97	2.98
4	Q	1943	11.88	8.91	5.94	2.97
1	Q	1944	11.92	8.94	5.96	2.98
2	Q	1944	11.81	8.86	5.90	2.95
3	Q	1944	11.69	8.76	5.84	2.92
4	Q	1944	11.65	8.74	5.83	2.91
1	Q	1945	11.64	8.73	5.82	2.91
2	Q	1945	11.53	8.65	5.77	2.88
3	Q	1945	11.43	8.57	5.72	2.86
4	Q	1945	11.42	8.56	5.71	2.85
1	Q	1946	11.37	8.53	5.69	2.84
2	Q	1946	11.19	8.39	5.59	2.80
3	Q	1946	10.28	7.71	5.14	2.57
4	Q	1946	9.75	7.31	4.88	2.44
1	Q	1947	9.57	7.18	4.78	2.39
2	Q	1947	9.43	7.07	4.71	2.36
3	Q	1947	9.17	6.88	4.58	2.29
4	Q	1947	8.92	6.69	4.46	2.23
1	Q	1948	8.79	6.59	4.39	2.20
2	Q	1948	8.64	6.48	4.32	2.16
3	Q	1948	8.46	6.34	4.23	2.11
4	Q	1948	8.54	6.40	4.27	2.13
1	Q	1949	8.66	6.50	4.33	2.17
2	Q	1949	8.67	6.51	4.34	2.17
3	Q	1949	8.70	6.53	4.35	2.18
4	Q	1949	8.73	6.54	4.36	2.18
1	Q	1950	13.19	9.89	6.60	3.30
2	Q	1950	13.09	9.81	6.54	3.27
3	Q	1950	12.79	9.59	6.40	3.20
4	Q	1950	12.54	9.40	6.27	3.13
1	Q	1951	14.53	10.90	7.26	3.63
2	Q	1951	14.38	10.79	7.19	3.60
3	Q	1951	14.33	10.75	7.16	3.58

Table A-11 (Continued)

Quarter of Investment			Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4	Q	1951	14.13	10.59	7.06	3.53
1	Q	1952	14.13	10.60	7.06	3.53
2	Q	1952	14.08	10.56	7.04	3.52
3	Q	1952	13.94	10.45	6.97	3.48
4	Q	1952	13.93	10.45	6.97	3.48
1	Q	1953	14.02	10.51	7.01	3.50
2	Q	1953	13.96	10.47	6.98	3.49
3	Q	1953	13.85	10.39	6.92	3.46
4	Q	1953	13.83	10.37	6.91	3.46
1	Q	1954	18.45	13.84	9.23	4.61
2	Q	1954	18.47	13.85	9.24	4.62
3	Q	1954	18.46	13.85	9.23	4.62
4	Q	1954	18.55	13.91	9.27	4.64
1	Q	1955	21.66	16.25	10.83	5.42
2	Q	1955	21.66	16.25	10.83	5.42
3	Q	1955	21.60	16.20	10.80	5.40
4	Q	1955	21.56	16.17	10.78	5.39
1	Q	1956	21.61	16.21	10.80	5.40
2	Q	1956	21.44	16.08	10.72	5.36
3	Q	1956	21.17	15.88	10.59	5.29
4	Q	1956	21.02	15.77	10.51	5.26
1	Q	1957	20.89	15.67	10.45	5.22
2	Q	1957	20.68	15.51	10.34	5.17
3	Q	1957	20.47	15.35	10.23	5.12
4	Q	1957	20.39	15.29	10.19	5.10
1	Q	1958	20.19	15.14	10.09	5.05
2	Q	1958	20.03	15.02	10.01	5.01
3	Q	1958	20.01	15.00	10.00	5.00
4	Q	1958	20.01	15.00	10.00	5.00
1	Q	1959	25.72	19.29	12.86	6.43
2	Q	1959	25.65	19.24	12.82	6.41
3	Q	1959	25.49	19.12	12.75	6.37
4	Q	1959	25.35	19.01	12.68	6.34
1	Q	1960	31.00	23.25	15.50	7.75
2	Q	1960	30.79	23.09	15.40	7.70
3	Q	1960	30.73	23.05	15.36	7.68
4	Q	1960	30.55	22.91	15.28	7.64
1	Q	1961	30.54	22.90	15.27	7.63
2	Q	1961	30.53	22.89	15.26	7.63
3	Q	1961	30.37	22.78	15.19	7.59
4	Q	1961	30.34	22.75	15.17	7.58
1	Q	1962	31.64	23.73	15.82	7.91
2	Q	1962	31.51	23.63	15.75	7.88
3	Q	1962	31.38	23.53	15.69	7.84
4	Q	1962	31.31	23.48	15.66	7.83
1	Q	1963	36.71	27.53	18.35	9.18
2	Q	1963	36.61	27.45	18.30	9.15
3	Q	1963	36.34	27.26	18.17	9.09
4	Q	1963	36.24	27.18	18.12	9.06
1	Q	1964	36.16	27.12	18.08	9.04
2	Q	1964	36.08	27.06	18.04	9.02
3	Q	1964	35.94	26.96	17.97	8.99
4	Q	1964	35.81	26.86	17.91	8.95
1	Q	1965	35.74	26.81	17.87	8.94
2	Q	1965	35.49	26.62	17.75	8.87
3	Q	1965	35.33	26.50	17.67	8.83
4	Q	1965	35.18	26.38	17.59	8.79
1	Q	1966	49.76	37.32	24.88	12.44
2	Q	1966	49.26	36.95	24.63	12.32
3	Q	1966	48.80	36.60	24.40	12.20

Table A-11 (Continued)

Quarter of Investment			Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4	Q	1966	48.44	36.33	24.22	12.11
1	Q	1967	49.03	36.77	24.51	12.26
2	Q	1967	48.70	36.52	24.35	12.17
3	Q	1967	48.18	36.13	24.09	12.04
4	Q	1967	47.79	35.84	23.89	11.95
1	Q	1968	52.35	39.26	26.18	13.09
2	Q	1968	51.76	38.82	25.88	12.94
3	Q	1968	51.13	38.34	25.56	12.78
4	Q	1968	50.52	37.89	25.26	12.63
1	Q	1969	55.97	41.97	27.98	13.99
2	Q	1969	55.00	41.25	27.50	13.75
3	Q	1969	54.23	40.67	27.11	13.56
4	Q	1969	53.49	40.12	26.75	13.37
1	Q	1970	51.64	38.73	25.82	12.91
2	Q	1970	50.82	38.11	25.41	12.70
3	Q	1970	50.26	37.69	25.13	12.56
4	Q	1970	49.61	37.21	24.80	12.40
1	Q	1971	54.63	40.97	27.32	13.66
2	Q	1971	54.01	40.51	27.00	13.50
3	Q	1971	53.48	40.11	26.74	13.37
4	Q	1971	53.20	39.90	26.60	13.30
1	Q	1972	60.90	45.68	30.45	15.23
2	Q	1972	60.40	45.30	30.20	15.10
3	Q	1972	59.86	44.90	29.93	14.97
4	Q	1972	59.32	44.49	29.66	14.83
1	Q	1973	74.55	55.91	37.27	18.64
2	Q	1973	72.94	54.70	36.47	18.23
3	Q	1973	71.37	53.53	35.69	17.84
4	Q	1973	69.75	52.31	34.87	17.44
1	Q	1974	84.36	63.27	42.18	21.09
2	Q	1974	82.04	61.53	41.02	20.51
3	Q	1974	79.62	59.71	39.81	19.90
4	Q	1974	77.36	58.02	38.68	19.34
1	Q	1975	81.16	60.87	40.58	20.29
2	Q	1975	79.91	59.93	39.95	19.98
3	Q	1975	78.23	58.67	39.12	19.56
4	Q	1975	77.01	57.75	38.50	19.25
1	Q	1976	82.76	62.07	41.38	20.69
2	Q	1976	62.05	46.54	31.03	15.51
3	Q	1976	80.47	60.35	40.23	20.12
4	Q	1976	79.57	59.68	39.79	19.89
1	Q	1977	84.33	63.25	42.16	21.08
2	Q	1977	82.55	61.91	41.28	20.64
3	Q	1977	81.37	61.03	40.69	20.34
4	Q	1977	80.46	60.35	40.23	20.12
1	Q	1978	82.98	62.23	41.49	20.74
2	Q	1978	80.86	60.64	40.43	20.21
3	Q	1978	79.01	59.26	39.51	19.75
4	Q	1978	77.47	58.10	38.74	19.37
1	Q	1979	98.98	74.23	49.49	24.74
2	Q	1979	95.77	71.83	47.89	23.94
3	Q	1979	92.65	69.48	46.32	23.16
4	Q	1979	90.02	67.51	45.01	22.50
1	Q	1980	102.28	76.71	51.14	25.57
2	Q	1980	98.71	74.03	49.36	24.68
3	Q	1980	96.89	72.67	48.44	24.22
4	Q	1980	94.42	70.81	47.21	23.60
1	Q	1981	109.68	82.26	54.84	27.42
2	Q	1981	107.20	80.40	53.60	26.80
3	Q	1981	104.21	78.16	52.11	26.05

Table A-11 (Continued)

Quarter of Investment	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4 Q 1981	102.74	77.06	51.37	25.69
1 Q 1982	108.21	81.16	54.11	27.05
2 Q 1982	106.58	79.94	53.29	26.65
3 Q 1982	104.60	78.45	52.30	26.15
4 Q 1982	104.39	78.29	52.20	26.10
1 Q 1983	120.10	90.08	60.05	30.03
2 Q 1983	118.62	88.96	59.31	29.65
3 Q 1983	117.21	87.91	58.61	29.30
4 Q 1983	116.21	87.16	58.10	29.05
1 Q 1984	132.55	99.42	66.28	33.14
2 Q 1984	131.11	98.34	65.56	32.78
3 Q 1984	129.71	97.28	64.86	32.43
4 Q 1984	128.78	96.58	64.39	32.19

Table A-12. Quarterly Nominal Investment Amounts
1937-1984.

Quarter of Investment			Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
1	Q	1937	14.68	11.01	7.34	3.67
2	Q	1937	14.68	11.01	7.34	3.67
3	Q	1937	14.68	11.01	7.34	3.67
4	Q	1937	14.68	11.01	7.34	3.67
1	Q	1938	14.68	11.01	7.34	3.67
2	Q	1938	14.68	11.01	7.34	3.67
3	Q	1938	14.68	11.01	7.34	3.67
4	Q	1938	14.68	11.01	7.34	3.67
1	Q	1939	14.68	11.01	7.34	3.67
2	Q	1939	14.68	11.01	7.34	3.67
3	Q	1939	14.68	11.01	7.34	3.67
4	Q	1939	14.68	11.01	7.34	3.67
1	Q	1940	14.68	11.01	7.34	3.67
2	Q	1940	14.68	11.01	7.34	3.67
3	Q	1940	14.68	11.01	7.34	3.67
4	Q	1940	14.68	11.01	7.34	3.67
1	Q	1941	14.68	11.01	7.34	3.67
2	Q	1941	14.68	11.01	7.34	3.67
3	Q	1941	14.68	11.01	7.34	3.67
4	Q	1941	14.68	11.01	7.34	3.67
1	Q	1942	14.68	11.01	7.34	3.67
2	Q	1942	14.68	11.01	7.34	3.67
3	Q	1942	14.68	11.01	7.34	3.67
4	Q	1942	14.68	11.01	7.34	3.67
1	Q	1943	14.68	11.01	7.34	3.67
2	Q	1943	14.68	11.01	7.34	3.67
3	Q	1943	14.68	11.01	7.34	3.67
4	Q	1943	14.68	11.01	7.34	3.67
1	Q	1944	14.68	11.01	7.34	3.67
2	Q	1944	14.68	11.01	7.34	3.67
3	Q	1944	14.68	11.01	7.34	3.67
4	Q	1944	14.68	11.01	7.34	3.67
1	Q	1945	14.68	11.01	7.34	3.67
2	Q	1945	14.68	11.01	7.34	3.67
3	Q	1945	14.68	11.01	7.34	3.67
4	Q	1945	14.68	11.01	7.34	3.67
1	Q	1946	14.68	11.01	7.34	3.67
2	Q	1946	14.68	11.01	7.34	3.67
3	Q	1946	14.68	11.01	7.34	3.67
4	Q	1946	14.68	11.01	7.34	3.67
1	Q	1947	14.68	11.01	7.34	3.67
2	Q	1947	14.68	11.01	7.34	3.67
3	Q	1947	14.68	11.01	7.34	3.67
4	Q	1947	14.68	11.01	7.34	3.67
1	Q	1948	14.68	11.01	7.34	3.67
2	Q	1948	14.68	11.01	7.34	3.67
3	Q	1948	14.68	11.01	7.34	3.67
4	Q	1948	14.68	11.01	7.34	3.67
1	Q	1949	14.68	11.01	7.34	3.67
2	Q	1949	14.68	11.01	7.34	3.67
3	Q	1949	14.68	11.01	7.34	3.67
4	Q	1949	14.68	11.01	7.34	3.67
1	Q	1950	22.03	16.52	11.01	5.51
2	Q	1950	22.03	16.52	11.01	5.51
3	Q	1950	22.03	16.52	11.01	5.51
4	Q	1950	22.03	16.52	11.01	5.51
1	Q	1951	26.43	19.82	13.22	6.61
2	Q	1951	26.43	19.82	13.22	6.61
3	Q	1951	26.43	19.82	13.22	6.61

Table A-12 (Continued)

Quarter of Investment			Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4	Q	1951	26.43	19.82	13.22	6.61
1	Q	1952	26.43	19.82	13.22	6.61
2	Q	1952	26.43	19.82	13.22	6.61
3	Q	1952	26.43	19.82	13.22	6.61
4	Q	1952	26.43	19.82	13.22	6.61
1	Q	1953	26.43	19.82	13.22	6.61
2	Q	1953	26.43	19.82	13.22	6.61
3	Q	1953	26.43	19.82	13.22	6.61
4	Q	1953	26.43	19.82	13.22	6.61
1	Q	1954	35.24	26.43	17.62	8.81
2	Q	1954	35.24	26.43	17.62	8.81
3	Q	1954	35.24	26.43	17.62	8.81
4	Q	1954	35.24	26.43	17.62	8.81
1	Q	1955	41.12	30.84	20.56	10.28
2	Q	1955	41.12	30.84	20.56	10.28
3	Q	1955	41.12	30.84	20.56	10.28
4	Q	1955	41.12	30.84	20.56	10.28
1	Q	1956	41.12	30.84	20.56	10.28
2	Q	1956	41.12	30.84	20.56	10.28
3	Q	1956	41.12	30.84	20.56	10.28
4	Q	1956	41.12	30.84	20.56	10.28
1	Q	1957	41.12	30.84	20.56	10.28
2	Q	1957	41.12	30.84	20.56	10.28
3	Q	1957	41.12	30.84	20.56	10.28
4	Q	1957	41.12	30.84	20.56	10.28
1	Q	1958	41.12	30.84	20.56	10.28
2	Q	1958	41.12	30.84	20.56	10.28
3	Q	1958	41.12	30.84	20.56	10.28
4	Q	1958	41.12	30.84	20.56	10.28
1	Q	1959	52.86	39.65	26.43	13.22
2	Q	1959	52.86	39.65	26.43	13.22
3	Q	1959	52.86	39.65	26.43	13.22
4	Q	1959	52.86	39.65	26.43	13.22
1	Q	1960	64.61	48.46	32.31	16.15
2	Q	1960	64.61	48.46	32.31	16.15
3	Q	1960	64.61	48.46	32.31	16.15
4	Q	1960	64.61	48.46	32.31	16.15
1	Q	1961	64.61	48.46	32.31	16.15
2	Q	1961	64.61	48.46	32.31	16.15
3	Q	1961	64.61	48.46	32.31	16.15
4	Q	1961	64.61	48.46	32.31	16.15
1	Q	1962	67.55	50.66	33.77	16.89
2	Q	1962	67.55	50.66	33.77	16.89
3	Q	1962	67.55	50.66	33.77	16.89
4	Q	1962	67.55	50.66	33.77	16.89
1	Q	1963	79.30	59.47	39.65	19.82
2	Q	1963	79.30	59.47	39.65	19.82
3	Q	1963	79.30	59.47	39.65	19.82
4	Q	1963	79.30	59.47	39.65	19.82
1	Q	1964	79.30	59.47	39.65	19.82
2	Q	1964	79.30	59.47	39.65	19.82
3	Q	1964	79.30	59.47	39.65	19.82
4	Q	1964	79.30	59.47	39.65	19.82
1	Q	1965	79.30	59.47	39.65	19.82
2	Q	1965	79.30	59.47	39.65	19.82
3	Q	1965	79.30	59.47	39.65	19.82
4	Q	1965	79.30	59.47	39.65	19.82
1	Q	1966	113.07	84.80	56.53	28.27
2	Q	1966	113.07	84.80	56.53	28.27
3	Q	1966	113.07	84.80	56.53	28.27

Table A-12 (Continued)

Quarter of Investment	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4 Q 1966	113.07	84.80	56.53	28.27
1 Q 1967	114.68	86.01	57.34	28.67
2 Q 1967	114.68	86.01	57.34	28.67
3 Q 1967	114.68	86.01	57.34	28.67
4 Q 1967	114.68	86.01	57.34	28.67
1 Q 1968	126.95	95.21	63.47	31.74
2 Q 1968	126.95	95.21	63.47	31.74
3 Q 1968	126.95	95.21	63.47	31.74
4 Q 1968	126.95	95.21	63.47	31.74
1 Q 1969	142.22	106.66	71.11	35.55
2 Q 1969	142.22	106.66	71.11	35.55
3 Q 1969	142.22	106.66	71.11	35.55
4 Q 1969	142.22	106.66	71.11	35.55
1 Q 1970	139.35	104.52	69.68	34.84
2 Q 1970	139.35	104.52	69.68	34.84
3 Q 1970	139.35	104.52	69.68	34.84
4 Q 1970	139.35	104.52	69.68	34.84
1 Q 1971	154.63	115.97	77.31	38.66
2 Q 1971	154.63	115.97	77.31	38.66
3 Q 1971	154.63	115.97	77.31	38.66
4 Q 1971	154.63	115.97	77.31	38.66
1 Q 1972	178.41	133.81	89.21	44.60
2 Q 1972	178.41	133.81	89.21	44.60
3 Q 1972	178.41	133.81	89.21	44.60
4 Q 1972	178.41	133.81	89.21	44.60
1 Q 1973	227.31	170.49	113.66	56.83
2 Q 1973	227.31	170.49	113.66	56.83
3 Q 1973	227.31	170.49	113.66	56.83
4 Q 1973	227.31	170.49	113.66	56.83
1 Q 1974	282.67	212.01	141.34	70.67
2 Q 1974	282.67	212.01	141.34	70.67
3 Q 1974	282.67	212.01	141.34	70.67
4 Q 1974	282.67	212.01	141.34	70.67
1 Q 1975	301.95	226.46	150.97	75.49
2 Q 1975	301.95	226.46	150.97	75.49
3 Q 1975	301.95	226.46	150.97	75.49
4 Q 1975	301.95	226.46	150.97	75.49
1 Q 1976	327.64	245.73	163.82	81.91
2 Q 1976	327.64	245.73	163.82	81.91
3 Q 1976	327.64	245.73	163.82	81.91
4 Q 1976	327.64	245.73	163.82	81.91
1 Q 1977	353.34	265.01	176.67	88.34
2 Q 1977	353.34	265.01	176.67	88.34
3 Q 1977	353.34	265.01	176.67	88.34
4 Q 1977	353.34	265.01	176.67	88.34
1 Q 1978	370.38	277.78	185.19	92.59
2 Q 1978	370.38	277.78	185.19	92.59
3 Q 1978	370.38	277.78	185.19	92.59
4 Q 1978	370.38	277.78	185.19	92.59
1 Q 1979	485.35	364.01	242.68	121.34
2 Q 1979	485.35	364.01	242.68	121.34
3 Q 1979	485.35	364.01	242.68	121.34
4 Q 1979	485.35	364.01	242.68	121.34
1 Q 1980	573.02	429.77	286.51	143.26
2 Q 1980	573.02	429.77	286.51	143.26
3 Q 1980	573.02	429.77	286.51	143.26
4 Q 1980	573.02	429.77	286.51	143.26
1 Q 1981	683.26	512.45	341.63	170.82
2 Q 1981	683.26	512.45	341.63	170.82
3 Q 1981	683.26	512.45	341.63	170.82

Table A-12 (Continued)

Quarter of Investment	Maximum Earnings Case	75% of Maximum Earnings Case	50% of Maximum Earnings Case	25% of Maximum Earnings Case
4 Q 1981	683.26	512.45	341.63	170.82
1 Q 1982	725.55	544.16	362.78	181.39
2 Q 1982	725.55	544.16	362.78	181.39
3 Q 1982	725.55	544.16	362.78	181.39
4 Q 1982	725.55	544.16	362.78	181.39
1 Q 1983	834.40	625.80	417.20	208.60
2 Q 1983	834.40	625.80	417.20	208.60
3 Q 1983	834.40	625.80	417.20	208.60
4 Q 1983	834.40	625.80	417.20	208.60
1 Q 1984	962.12	721.59	481.06	240.53
2 Q 1984	962.12	721.59	481.06	240.53
3 Q 1984	962.12	721.59	481.06	240.53
4 Q 1984	962.12	721.59	481.06	240.53

Table A-13. Quarterly Price Index, 1937-1984 (January, 1937
Price Index Equals 1.000).

Quarter			Value ^a
1	Q	1937	1.004
2	Q	1937	1.018
3	Q	1937	1.031
4	Q	1937	1.027
1	Q	1938	1.003
2	Q	1938	1.002
3	Q	1938	1.001
4	Q	1938	0.994
1	Q	1939	0.986
2	Q	1939	0.981
3	Q	1939	0.987
4	Q	1939	0.993
1	Q	1940	0.992
2	Q	1940	0.995
3	Q	1940	0.994
4	Q	1940	0.997
1	Q	1941	1.002
2	Q	1941	1.025
3	Q	1941	1.058
4	Q	1941	1.092
1	Q	1942	1.122
2	Q	1942	1.151
3	Q	1942	1.166
4	Q	1942	1.190
1	Q	1943	1.207
2	Q	1943	1.240
3	Q	1943	1.230
4	Q	1943	1.236
1	Q	1944	1.232
2	Q	1944	1.243
3	Q	1944	1.257
4	Q	1944	1.260
1	Q	1945	1.262
2	Q	1945	1.273
3	Q	1945	1.285
4	Q	1945	1.286
1	Q	1946	1.291
2	Q	1946	1.313
3	Q	1946	1.429
4	Q	1946	1.506
1	Q	1947	1.535
2	Q	1947	1.557
3	Q	1947	1.601
4	Q	1947	1.646
1	Q	1948	1.671
2	Q	1948	1.699
3	Q	1948	1.737
4	Q	1948	1.720
1	Q	1949	1.695
2	Q	1949	1.693
3	Q	1949	1.687
4	Q	1949	1.683
1	Q	1950	1.670
2	Q	1950	1.683
3	Q	1950	1.722
4	Q	1950	1.757
1	Q	1951	1.819
2	Q	1951	1.838
3	Q	1951	1.845
4	Q	1951	1.871
1	Q	1952	1.871
2	Q	1952	1.877

Table A-13 (Continued)

Quarter			Value
3	Q	1952	1.897
4	Q	1952	1.897
1	Q	1953	1.886
2	Q	1953	1.894
3	Q	1953	1.909
4	Q	1953	1.911
1	Q	1954	1.910
2	Q	1954	1.908
3	Q	1954	1.909
4	Q	1954	1.900
1	Q	1955	1.898
2	Q	1955	1.898
3	Q	1955	1.904
4	Q	1955	1.907
1	Q	1956	1.903
2	Q	1956	1.918
3	Q	1956	1.942
4	Q	1956	1.956
1	Q	1957	1.968
2	Q	1957	1.988
3	Q	1957	2.009
4	Q	1957	2.017
1	Q	1958	2.037
2	Q	1958	2.053
3	Q	1958	2.055
4	Q	1958	2.055
1	Q	1959	2.055
2	Q	1959	2.061
3	Q	1959	2.074
4	Q	1959	2.085
1	Q	1960	2.084
2	Q	1960	2.098
3	Q	1960	2.103
4	Q	1960	2.115
1	Q	1961	2.116
2	Q	1961	2.117
3	Q	1961	2.127
4	Q	1961	2.130
1	Q	1962	2.135
2	Q	1962	2.144
3	Q	1962	2.153
4	Q	1962	2.157
1	Q	1963	2.160
2	Q	1963	2.166
3	Q	1963	2.182
4	Q	1963	2.188
1	Q	1964	2.193
2	Q	1964	2.198
3	Q	1964	2.206
4	Q	1964	2.214
1	Q	1965	2.218
2	Q	1965	2.234
3	Q	1965	2.244
4	Q	1965	2.254
1	Q	1966	2.272
2	Q	1966	2.295
3	Q	1966	2.317
4	Q	1966	2.334
1	Q	1967	2.339
2	Q	1967	2.355
3	Q	1967	2.380
4	Q	1967	2.400
1	Q	1968	2.425

Table A-13 (Continued)

Quarter			Value
2	Q	1968	2.453
3	Q	1968	2.483
4	Q	1968	2.513
1	Q	1969	2.541
2	Q	1969	2.586
3	Q	1969	2.623
4	Q	1969	2.659
1	Q	1970	2.698
2	Q	1970	2.742
3	Q	1970	2.773
4	Q	1970	2.809
1	Q	1971	2.830
2	Q	1971	2.863
3	Q	1971	2.891
4	Q	1971	2.907
1	Q	1972	2.930
2	Q	1972	2.954
3	Q	1972	2.980
4	Q	1972	3.008
1	Q	1973	3.049
2	Q	1973	3.117
3	Q	1973	3.185
4	Q	1973	3.259
1	Q	1974	3.351
2	Q	1974	3.446
3	Q	1974	3.550
4	Q	1974	3.654
1	Q	1975	3.721
2	Q	1975	3.779
3	Q	1975	3.860
4	Q	1975	3.921
1	Q	1976	3.959
2	Q	1976	5.280
3	Q	1976	4.072
4	Q	1976	4.117
1	Q	1977	4.190
2	Q	1977	4.280
3	Q	1977	4.342
4	Q	1977	4.391
1	Q	1978	4.464
2	Q	1978	4.581
3	Q	1978	4.687
4	Q	1978	4.781
1	Q	1979	4.904
2	Q	1979	5.068
3	Q	1979	5.239
4	Q	1979	5.392
1	Q	1980	5.603
2	Q	1980	5.805
3	Q	1980	5.914
4	Q	1980	6.069
1	Q	1981	6.229
2	Q	1981	6.374
3	Q	1981	6.556
4	Q	1981	6.650
1	Q	1982	6.705
2	Q	1982	6.807
3	Q	1982	6.936
4	Q	1982	6.950
1	Q	1983	6.947
2	Q	1983	7.034
3	Q	1983	7.119
4	Q	1983	7.180

Table A-13 (Continued)

<u>Quarter</u>		<u>Value</u>
1	Q 1984	7.258
2	Q 1984	7.338
3	Q 1984	7.417
4	Q 1984	7.471

^aIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), p. 128.

Table A-14. Quarterly Social Security Earnings 1937-1984.^a

Quarter			Maximum Earnings	75% of Maximum Earnings	50% of Maximum Earnings	25% of Maximum Earnings
1	Q	1937	750.00	562.50	375.00	187.50
2	Q	1937	750.00	562.50	375.00	187.50
3	Q	1937	750.00	562.50	375.00	187.50
4	Q	1937	750.00	562.50	375.00	187.50
1	Q	1938	750.00	562.50	375.00	187.50
2	Q	1938	750.00	562.50	375.00	187.50
3	Q	1938	750.00	562.50	375.00	187.50
4	Q	1938	750.00	562.50	375.00	187.50
1	Q	1939	750.00	562.50	375.00	187.50
2	Q	1939	750.00	562.50	375.00	187.50
3	Q	1939	750.00	562.50	375.00	187.50
4	Q	1939	750.00	562.50	375.00	187.50
1	Q	1940	750.00	562.50	375.00	187.50
2	Q	1940	750.00	562.50	375.00	187.50
3	Q	1940	750.00	562.50	375.00	187.50
4	Q	1940	750.00	562.50	375.00	187.50
1	Q	1941	750.00	562.50	375.00	187.50
2	Q	1941	750.00	562.50	375.00	187.50
3	Q	1941	750.00	562.50	375.00	187.50
4	Q	1941	750.00	562.50	375.00	187.50
1	Q	1942	750.00	562.50	375.00	187.50
2	Q	1942	750.00	562.50	375.00	187.50
3	Q	1942	750.00	562.50	375.00	187.50
4	Q	1942	750.00	562.50	375.00	187.50
1	Q	1943	750.00	562.50	375.00	187.50
2	Q	1943	750.00	562.50	375.00	187.50
3	Q	1943	750.00	562.50	375.00	187.50
4	Q	1943	750.00	562.50	375.00	187.50
1	Q	1944	750.00	562.50	375.00	187.50
2	Q	1944	750.00	562.50	375.00	187.50
3	Q	1944	750.00	562.50	375.00	187.50
4	Q	1944	750.00	562.50	375.00	187.50
1	Q	1945	750.00	562.50	375.00	187.50
2	Q	1945	750.00	562.50	375.00	187.50
3	Q	1945	750.00	562.50	375.00	187.50
4	Q	1945	750.00	562.50	375.00	187.50
1	Q	1946	750.00	562.50	375.00	187.50
2	Q	1946	750.00	562.50	375.00	187.50
3	Q	1946	750.00	562.50	375.00	187.50
4	Q	1946	750.00	562.50	375.00	187.50
1	Q	1947	750.00	562.50	375.00	187.50
2	Q	1947	750.00	562.50	375.00	187.50
3	Q	1947	750.00	562.50	375.00	187.50
4	Q	1947	750.00	562.50	375.00	187.50
1	Q	1948	750.00	562.50	375.00	187.50
2	Q	1948	750.00	562.50	375.00	187.50
3	Q	1948	750.00	562.50	375.00	187.50
4	Q	1948	750.00	562.50	375.00	187.50
1	Q	1949	750.00	562.50	375.00	187.50
2	Q	1949	750.00	562.50	375.00	187.50
3	Q	1949	750.00	562.50	375.00	187.50
4	Q	1949	750.00	562.50	375.00	187.50
1	Q	1950	750.00	562.50	375.00	187.50
2	Q	1950	750.00	562.50	375.00	187.50
3	Q	1950	750.00	562.50	375.00	187.50
4	Q	1950	750.00	562.50	375.00	187.50
1	Q	1951	900.00	675.00	450.00	225.00
2	Q	1951	900.00	675.00	450.00	225.00
3	Q	1951	900.00	675.00	450.00	225.00
4	Q	1951	900.00	675.00	450.00	225.00
1	Q	1952	900.00	675.00	450.00	225.00

Table A-14 (Continued)

Quarter			Maximum Earnings	75% of Maximum Earnings	50% of Maximum Earnings	25% of Maximum Earnings
2	Q	1952	900.00	675.00	450.00	225.00
3	Q	1952	900.00	675.00	450.00	225.00
4	Q	1952	900.00	675.00	450.00	225.00
1	Q	1953	900.00	675.00	450.00	225.00
2	Q	1953	900.00	675.00	450.00	225.00
3	Q	1953	900.00	675.00	450.00	225.00
4	Q	1953	900.00	675.00	450.00	225.00
1	Q	1954	900.00	675.00	450.00	225.00
2	Q	1954	900.00	675.00	450.00	225.00
3	Q	1954	900.00	675.00	450.00	225.00
4	Q	1954	900.00	675.00	450.00	225.00
1	Q	1955	1050.00	787.50	525.00	262.50
2	Q	1955	1050.00	787.50	525.00	262.50
3	Q	1955	1050.00	787.50	525.00	262.50
4	Q	1955	1050.00	787.50	525.00	262.50
1	Q	1956	1050.00	787.50	525.00	262.50
2	Q	1956	1050.00	787.50	525.00	262.50
3	Q	1956	1050.00	787.50	525.00	262.50
4	Q	1956	1050.00	787.50	525.00	262.50
1	Q	1957	1050.00	787.50	525.00	262.50
2	Q	1957	1050.00	787.50	525.00	262.50
3	Q	1957	1050.00	787.50	525.00	262.50
4	Q	1957	1050.00	787.50	525.00	262.50
1	Q	1958	1050.00	787.50	525.00	262.50
2	Q	1958	1050.00	787.50	525.00	262.50
3	Q	1958	1050.00	787.50	525.00	262.50
4	Q	1958	1050.00	787.50	525.00	262.50
1	Q	1959	1200.00	900.00	600.00	300.00
2	Q	1959	1200.00	900.00	600.00	300.00
3	Q	1959	1200.00	900.00	600.00	300.00
4	Q	1959	1200.00	900.00	600.00	300.00
1	Q	1960	1200.00	900.00	600.00	300.00
2	Q	1960	1200.00	900.00	600.00	300.00
3	Q	1960	1200.00	900.00	600.00	300.00
4	Q	1960	1200.00	900.00	600.00	300.00
1	Q	1961	1200.00	900.00	600.00	300.00
2	Q	1961	1200.00	900.00	600.00	300.00
3	Q	1961	1200.00	900.00	600.00	300.00
4	Q	1961	1200.00	900.00	600.00	300.00
1	Q	1962	1200.00	900.00	600.00	300.00
2	Q	1962	1200.00	900.00	600.00	300.00
3	Q	1962	1200.00	900.00	600.00	300.00
4	Q	1962	1200.00	900.00	600.00	300.00
1	Q	1963	1200.00	900.00	600.00	300.00
2	Q	1963	1200.00	900.00	600.00	300.00
3	Q	1963	1200.00	900.00	600.00	300.00
4	Q	1963	1200.00	900.00	600.00	300.00
1	Q	1964	1200.00	900.00	600.00	300.00
2	Q	1964	1200.00	900.00	600.00	300.00
3	Q	1964	1200.00	900.00	600.00	300.00
4	Q	1964	1200.00	900.00	600.00	300.00
1	Q	1965	1200.00	900.00	600.00	300.00
2	Q	1965	1200.00	900.00	600.00	300.00
3	Q	1965	1200.00	900.00	600.00	300.00
4	Q	1965	1200.00	900.00	600.00	300.00
1	Q	1966	1650.00	1237.50	825.00	412.50
2	Q	1966	1650.00	1237.50	825.00	412.50
3	Q	1966	1650.00	1237.50	825.00	412.50
4	Q	1966	1650.00	1237.50	825.00	412.50
1	Q	1967	1650.00	1237.50	825.00	412.50
2	Q	1967	1650.00	1237.50	825.00	412.50

Table A-14 (Continued)

Quarter			Maximum Earnings	75% of Maximum Earnings	50% of Maximum Earnings	25% of Maximum Earnings
3	Q	1967	1650.00	1237.50	825.00	412.50
4	Q	1967	1650.00	1237.50	825.00	412.50
1	Q	1968	1950.00	1462.50	975.00	487.50
2	Q	1968	1950.00	1462.50	975.00	487.50
3	Q	1968	1950.00	1462.50	975.00	487.50
4	Q	1968	1950.00	1462.50	975.00	487.50
1	Q	1969	1950.00	1462.50	975.00	487.50
2	Q	1969	1950.00	1462.50	975.00	487.50
3	Q	1969	1950.00	1462.50	975.00	487.50
4	Q	1969	1950.00	1462.50	975.00	487.50
1	Q	1970	1950.00	1462.50	975.00	487.50
2	Q	1970	1950.00	1462.50	975.00	487.50
3	Q	1970	1950.00	1462.50	975.00	487.50
4	Q	1970	1950.00	1462.50	975.00	487.50
1	Q	1971	1950.00	1462.50	975.00	487.50
2	Q	1971	1950.00	1462.50	975.00	487.50
3	Q	1971	1950.00	1462.50	975.00	487.50
4	Q	1971	1950.00	1462.50	975.00	487.50
1	Q	1972	2250.00	1687.50	1125.00	562.50
2	Q	1972	2250.00	1687.50	1125.00	562.50
3	Q	1972	2250.00	1687.50	1125.00	562.50
4	Q	1972	2250.00	1687.50	1125.00	562.50
1	Q	1973	2700.00	2025.00	1350.00	675.00
2	Q	1973	2700.00	2025.00	1350.00	675.00
3	Q	1973	2700.00	2025.00	1350.00	675.00
4	Q	1973	2700.00	2025.00	1350.00	675.00
1	Q	1974	3300.00	2475.00	1650.00	825.00
2	Q	1974	3300.00	2475.00	1650.00	825.00
3	Q	1974	3300.00	2475.00	1650.00	825.00
4	Q	1974	3300.00	2475.00	1650.00	825.00
1	Q	1975	3525.00	2643.75	1762.50	881.25
2	Q	1975	3525.00	2643.75	1762.50	881.25
3	Q	1975	3525.00	2643.75	1762.50	881.25
4	Q	1975	3525.00	2643.75	1762.50	881.25
1	Q	1976	3825.00	2868.75	1912.50	956.25
2	Q	1976	3825.00	2868.75	1912.50	956.25
3	Q	1976	3825.00	2868.75	1912.50	956.25
4	Q	1976	3825.00	2868.75	1912.50	956.25
1	Q	1977	4125.00	3093.75	2062.50	1031.25
2	Q	1977	4125.00	3093.75	2062.50	1031.25
3	Q	1977	4125.00	3093.75	2062.50	1031.25
4	Q	1977	4125.00	3093.75	2062.50	1031.25
1	Q	1978	4425.00	3318.75	2212.50	1106.25
2	Q	1978	4425.00	3318.75	2212.50	1106.25
3	Q	1978	4425.00	3318.75	2212.50	1106.25
4	Q	1978	4425.00	3318.75	2212.50	1106.25
1	Q	1979	5725.00	4293.75	2862.50	1431.25
2	Q	1979	5725.00	4293.75	2862.50	1431.25
3	Q	1979	5725.00	4293.75	2862.50	1431.25
4	Q	1979	5725.00	4293.75	2862.50	1431.25
1	Q	1980	6475.00	4856.25	3237.50	1618.75
2	Q	1980	6475.00	4856.25	3237.50	1618.75
3	Q	1980	6475.00	4856.25	3237.50	1618.75
4	Q	1980	6475.00	4856.25	3237.50	1618.75
1	Q	1981	7425.00	5568.75	3712.50	1856.25
2	Q	1981	7425.00	5568.75	3712.50	1856.25
3	Q	1981	7425.00	5568.75	3712.50	1856.25
4	Q	1981	7425.00	5568.75	3712.50	1856.25
1	Q	1982	8100.00	6075.00	4050.00	2025.00
2	Q	1982	8100.00	6075.00	4050.00	2025.00
3	Q	1982	8100.00	6075.00	4050.00	2025.00

Table A-14 (Continued)

Quarter	Maximum Earnings	75% of Maximum Earnings	50% of Maximum Earnings	25% of Maximum Earnings
4 Q 1982	8100.00	6075.00	4050.00	2025.00
1 Q 1983	8925.00	6693.75	4462.50	2231.25
2 Q 1983	8925.00	6693.75	4462.50	2231.25
3 Q 1983	8925.00	6693.75	4462.50	2231.25
4 Q 1983	8925.00	6693.75	4462.50	2231.25
1 Q 1984	9450.00	7087.50	4725.00	2362.50
2 Q 1984	9450.00	7087.50	4725.00	2362.50
3 Q 1984	9450.00	7087.50	4725.00	2362.50
4 Q 1984	9450.00	7087.50	4725.00	2362.50

^aU. S. Department of Health and Human Services: Social Security Administration, Social Security Bulletin: Annual Statistical Supplement, 1982 (Washington, 1983), p. 19.

Table A-15. Social Security Administrative Expenses As a Percentage of Old Age and Survivors Insurance Tax Collections 1940-1984.^a

<u>Year</u>	<u>Percentage</u>
1940	0.080
1941	0.033
1942	0.028
1943	0.023
1944	0.022
1945	0.023
1946	0.031
1947	0.030
1948	0.030
1949	0.032
1950	0.023
1951	0.024
1952	0.023
1953	0.022
1954	0.018
1955	0.021
1956	0.021
1957	0.021
1958	0.024
1959	0.025
1960	0.018
1961	0.021
1962	0.021
1963	0.019
1964	0.019
1965	0.019
1966	0.016
1967	0.017
1968	0.019
1969	0.017
1970	0.015
1971	0.016
1972	0.018
1973	0.014
1974	0.016
1975	0.016
1976	0.015
1977	0.014
1978	0.014
1979	0.013
1980	0.012
1981	0.011
1982	0.012
1983	0.011
1984	0.010

^aBruce D. Schobel, Administrative Expenses Under OASDI, U. S. Department of Health and Human Services, Social Security Administration, Actuarial Note Number 101 (Washington, 1980), p. 5 and U. S. Department of Health and Human Service, Social Security Administration, Net Administrative Expenses as a Percentage of Contribution Income and of Benefit Payments, by Trust Fund, Fiscal Years 1975-1985 (Washington, 1986), n. pag.

Table A-16. Quarterly Combined Employer and Employee Contribution Rates.

Quarter			Value
1	Q	1937	0.0200
2	Q	1937	0.0200
3	Q	1937	0.0200
4	Q	1937	0.0200
1	Q	1938	0.0200
2	Q	1938	0.0200
3	Q	1938	0.0200
4	Q	1938	0.0200
1	Q	1939	0.0200
2	Q	1939	0.0200
3	Q	1939	0.0200
4	Q	1939	0.0200
1	Q	1940	0.0200
2	Q	1940	0.0200
3	Q	1940	0.0200
4	Q	1940	0.0200
1	Q	1941	0.0200
2	Q	1941	0.0200
3	Q	1941	0.0200
4	Q	1941	0.0200
1	Q	1942	0.0200
2	Q	1942	0.0200
3	Q	1942	0.0200
4	Q	1942	0.0200
1	Q	1943	0.0200
2	Q	1943	0.0200
3	Q	1943	0.0200
4	Q	1943	0.0200
1	Q	1944	0.0200
2	Q	1944	0.0200
3	Q	1944	0.0200
4	Q	1944	0.0200
1	Q	1945	0.0200
2	Q	1945	0.0200
3	Q	1945	0.0200
4	Q	1945	0.0200
1	Q	1946	0.0200
2	Q	1946	0.0200
3	Q	1946	0.0200
4	Q	1946	0.0200
1	Q	1947	0.0200
2	Q	1947	0.0200
3	Q	1947	0.0200
4	Q	1947	0.0200
1	Q	1948	0.0200
2	Q	1948	0.0200
3	Q	1948	0.0200
4	Q	1948	0.0200
1	Q	1949	0.0200
2	Q	1949	0.0200
3	Q	1949	0.0200
4	Q	1949	0.0200
1	Q	1950	0.0300
2	Q	1950	0.0300
3	Q	1950	0.0300
4	Q	1950	0.0300
1	Q	1951	0.0300
2	Q	1951	0.0300
3	Q	1951	0.0300
4	Q	1951	0.0300
1	Q	1952	0.0300
2	Q	1952	0.0300

Table A-16 (Continued)

Quarter			Value
3	Q	1952	0.0300
4	Q	1952	0.0300
1	Q	1953	0.0300
2	Q	1953	0.0300
3	Q	1953	0.0300
4	Q	1953	0.0300
1	Q	1954	0.0400
2	Q	1954	0.0400
3	Q	1954	0.0400
4	Q	1954	0.0400
1	Q	1955	0.0400
2	Q	1955	0.0400
3	Q	1955	0.0400
4	Q	1955	0.0400
1	Q	1956	0.0400
2	Q	1956	0.0400
3	Q	1956	0.0400
4	Q	1956	0.0400
1	Q	1957	0.0400
2	Q	1957	0.0400
3	Q	1957	0.0400
4	Q	1957	0.0400
1	Q	1958	0.0400
2	Q	1958	0.0400
3	Q	1958	0.0400
4	Q	1958	0.0400
1	Q	1959	0.0450
2	Q	1959	0.0450
3	Q	1959	0.0450
4	Q	1959	0.0450
1	Q	1960	0.0550
2	Q	1960	0.0550
3	Q	1960	0.0550
4	Q	1960	0.0550
1	Q	1961	0.0550
2	Q	1961	0.0550
3	Q	1961	0.0550
4	Q	1961	0.0550
1	Q	1962	0.0575
2	Q	1962	0.0575
3	Q	1962	0.0575
4	Q	1962	0.0575
1	Q	1963	0.0675
2	Q	1963	0.0675
3	Q	1963	0.0675
4	Q	1963	0.0675
1	Q	1964	0.0675
2	Q	1964	0.0675
3	Q	1964	0.0675
4	Q	1964	0.0675
1	Q	1965	0.0675
2	Q	1965	0.0675
3	Q	1965	0.0675
4	Q	1965	0.0675
1	Q	1966	0.0700
2	Q	1966	0.0700
3	Q	1966	0.0700
4	Q	1966	0.0700
1	Q	1967	0.0710
2	Q	1967	0.0710
3	Q	1967	0.0710
4	Q	1967	0.0710
1	Q	1968	0.0665

Table A-16 (Continued)

Quarter			Value
2	Q	1968	0.0665
3	Q	1968	0.0665
4	Q	1968	0.0665
1	Q	1969	0.0745
2	Q	1969	0.0745
3	Q	1969	0.0745
4	Q	1969	0.0745
1	Q	1970	0.0730
2	Q	1970	0.0730
3	Q	1970	0.0730
4	Q	1970	0.0730
1	Q	1971	0.0810
2	Q	1971	0.0810
3	Q	1971	0.0810
4	Q	1971	0.0810
1	Q	1972	0.0810
2	Q	1972	0.0810
3	Q	1972	0.0810
4	Q	1972	0.0810
1	Q	1973	0.0860
2	Q	1973	0.0860
3	Q	1973	0.0860
4	Q	1973	0.0860
1	Q	1974	0.0875
2	Q	1974	0.0875
3	Q	1974	0.0875
4	Q	1974	0.0875
1	Q	1975	0.0875
2	Q	1975	0.0875
3	Q	1975	0.0875
4	Q	1975	0.0875
1	Q	1976	0.0875
2	Q	1976	0.0875
3	Q	1976	0.0875
4	Q	1976	0.0875
1	Q	1977	0.0875
2	Q	1977	0.0875
3	Q	1977	0.0875
4	Q	1977	0.0875
1	Q	1978	0.0855
2	Q	1978	0.0855
3	Q	1978	0.0855
4	Q	1978	0.0855
1	Q	1979	0.0866
2	Q	1979	0.0866
3	Q	1979	0.0866
4	Q	1979	0.0866
1	Q	1980	0.0904
2	Q	1980	0.0904
3	Q	1980	0.0904
4	Q	1980	0.0904
1	Q	1981	0.0940
2	Q	1981	0.0940
3	Q	1981	0.0940
4	Q	1981	0.0940
1	Q	1982	0.0915
2	Q	1982	0.0915
3	Q	1982	0.0915
4	Q	1982	0.0915
1	Q	1983	0.0955
2	Q	1983	0.0955
3	Q	1983	0.0955
4	Q	1983	0.0955

Table A-16 (Continued)

Quarter	Value
1 Q 1984	0.1040
2 Q 1984	0.1040
3 Q 1984	0.1040
4 Q 1984	0.1040

^aU. S. Department of Health and Human Services, Social Security Administration, Social Security Bulletin: Annual Statistical Supplement, 1982, (Washington, 1983), p. 19.

Table A-17. Discounted Benefit Streams (Expressed in January, 1937 Dollars) for Male Workers and When the Rates of Discount Equal the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	5876.46	4957.91	4039.36	3120.80
1941	5986.81	5051.37	4115.93	3180.49
1942	5538.94	4540.61	3807.36	2934.32
1943	5066.69	4274.42	3483.35	2691.08
1944	5112.31	4313.21	3514.11	2715.02
1945	5104.27	4306.72	3509.18	2711.64
1946	5130.24	4327.76	3526.45	2725.15
1947	4308.94	3635.18	2962.40	2288.64
1948	3965.07	3345.31	2725.54	2105.77
1949	3977.72	3356.20	2734.68	2113.16
1950	4095.67	3455.04	2815.32	2175.60
1951	6067.60	5520.59	4838.93	3871.15
1952	5585.59	5145.27	4558.17	3677.52
1953	6868.13	6464.12	5050.10	3337.10
1954	6940.34	6532.09	5103.19	3372.19
1955	7870.96	6796.54	5575.60	3361.64
1956	8382.23	7054.03	5742.03	3612.05
1957	8422.85	7056.56	5705.80	3718.47
1958	8162.73	6838.64	5529.59	3603.64
1959	8704.27	7278.57	5927.91	3826.88
1960	8715.15	7250.42	5858.92	3881.54
1961	8763.12	7302.60	5915.11	3943.41
1962	8678.97	7244.43	5809.89	3944.99
1963	8518.78	7122.26	5725.74	3840.43
1964	8612.22	7141.84	5741.48	3921.01
1965	9065.59	7592.52	6043.73	4130.11
1966	8918.68	7413.19	5900.98	4032.56
1967	8941.75	7395.53	5915.11	4158.34
1968	8639.16	7168.00	5696.84	4087.95
1969	11231.51	9308.89	7361.93	5341.96
1970	10973.37	9100.15	7163.34	5238.08
1971	11701.23	9664.08	7572.03	5551.36
1972	11448.75	9488.53	7385.26	5356.17
1973	13701.97	11261.26	8805.10	6348.94
1974	13207.02	10879.20	8493.66	6016.75
1975	13829.79	11424.99	8836.55	6252.48
1976	14958.82	12193.08	9419.12	6530.10
1977	16313.36	13159.00	10103.45	6960.95
1978	17075.61	13878.11	10606.34	7204.59
1979	17363.16	14238.20	10861.46	7308.81
1980	17148.97	14396.74	10891.99	7246.34
1981	18425.89	15919.20	11926.48	7797.66
1982	17141.78	14323.09	10780.17	7227.15
1983	17376.08	14890.29	11179.96	7454.94
1984	16650.86	14352.97	10760.58	7165.83
1985	16498.31	14280.75	10703.66	7085.17

Table A-18. Discounted Benefit Streams (Expressed in January, 1937 Dollars) for Female Workers and When the Rates of Discount Equal the Average Historical Real Yield on One-Month Treasury Bills.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	6604.12	5571.82	4539.53	3507.23
1941	6780.29	5720.87	4661.45	3602.03
1942	6268.60	5138.76	4308.92	3320.87
1943	5729.27	4833.40	3938.88	3043.00
1944	5769.32	4867.53	3965.73	3063.94
1945	5799.38	4893.23	3987.08	3080.92
1946	5808.39	4899.83	3992.60	3085.37
1947	4938.74	4166.50	3395.38	2623.14
1948	4581.12	3865.06	3149.00	2432.95
1949	4620.75	3898.76	3176.77	2454.77
1950	4805.27	4053.65	3303.09	2552.54
1951	7139.50	6495.85	5693.77	4555.02
1952	6574.94	6056.63	5365.54	4328.90
1953	8130.07	7651.83	5978.00	3950.26
1954	8243.65	7758.73	6061.50	4005.44
1955	9382.75	8101.96	6646.52	4007.32
1956	10047.55	8455.48	6882.82	4329.67
1957	10160.77	8512.57	6883.10	4485.72
1958	9872.56	8271.11	6687.86	4358.48
1959	10548.21	8820.48	7183.69	4637.57
1960	10688.79	8892.35	7185.74	4760.55
1961	10754.17	8961.81	7259.07	4839.38
1962	10897.25	9036.75	7264.84	4961.35
1963	10904.03	8984.92	7240.28	4972.24
1964	11099.08	9176.40	7341.12	5156.26
1965	11782.77	9745.28	7794.49	5479.55
1966	11543.46	9547.35	7636.18	5368.26
1967	11689.31	9652.03	7689.90	5452.23
1968	11557.34	9601.48	7524.40	5536.21
1969	15124.37	12467.39	9849.71	7121.98
1970	14715.80	12198.23	9605.73	6885.86
1971	15722.76	12997.67	10165.58	7326.35
1972	15547.89	12821.65	10074.64	7210.01
1973	18628.43	15352.95	11902.25	8566.11
1974	17862.12	14758.66	11410.69	8075.26
1975	19092.81	15585.50	12038.14	8416.40
1976	20363.84	16380.31	12676.33	8768.06
1977	21898.36	17491.73	13499.84	9248.74
1978	22320.14	18140.57	13863.92	9417.37
1979	22667.60	18587.97	14179.63	9541.64
1980	22310.38	18729.80	14170.21	9427.31
1981	23930.18	20674.68	15489.22	10127.02
1982	22303.23	18635.82	14026.12	9403.28
1983	22618.04	19382.34	14552.70	9703.92
1984	21698.12	18703.68	14022.37	9337.96
1985	21508.41	18617.43	13954.08	9236.74

Table A-19. Discounted Benefit Streams (Expressed in January, 1937 Dollars) for Male Workers and When the Rates of Discount Equal the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	5006.85	4224.23	3441.60	2658.98
1941	5084.46	4290.01	3495.57	2701.12
1942	4690.79	3845.33	3224.36	2485.00
1943	4306.35	3632.97	2960.62	2287.24
1944	4325.04	3649.00	2972.96	2296.92
1945	4309.36	3636.03	2962.69	2289.35
1946	4318.52	3643.01	2968.49	2293.97
1947	3637.43	3068.67	2500.74	1931.97
1948	3344.14	2821.43	2298.72	1776.01
1949	3350.08	2826.63	2303.18	1779.73
1950	3449.86	2910.25	2371.40	1832.55
1951	5108.89	4648.31	4074.35	3259.48
1952	4695.20	4325.07	3831.56	3091.29
1953	5776.26	5436.48	4247.25	2806.58
1954	5815.34	5473.26	4275.99	2825.57
1955	6606.94	5705.06	4680.20	2821.79
1956	7039.72	5924.24	4822.38	3033.54
1957	7087.44	5937.77	4801.17	3128.93
1958	6865.04	5751.45	4650.51	3030.74
1959	7308.30	6111.25	4977.21	3213.13
1960	7331.52	6099.33	4928.75	3265.30
1961	7355.83	6129.86	4965.19	3310.12
1962	7299.22	6092.73	4886.25	3317.83
1963	7181.05	6003.83	4826.61	3237.36
1964	7236.57	6001.06	4824.38	3294.70
1965	7625.35	6386.30	5083.56	3473.96
1966	7507.55	6240.26	4967.32	3394.52
1967	7512.51	6213.44	4969.64	3493.68
1968	7277.86	6038.51	4799.17	3443.80
1969	9435.06	7819.96	6184.41	4487.53
1970	9204.06	7632.87	6008.34	4393.51
1971	9815.81	8106.91	6351.95	4656.87
1972	9608.93	7963.72	6198.45	4495.43
1973	11485.34	9439.48	7380.66	5321.84
1974	11029.47	9085.46	7093.24	5024.72
1975	11517.15	9514.48	7358.89	5206.93
1976	12449.43	10147.65	7839.04	5434.66
1977	13549.06	10929.20	8391.42	5781.41
1978	14174.92	11520.59	8804.60	5980.72
1979	14371.45	11784.93	8990.01	6049.48
1980	14219.49	11937.41	9031.37	6008.48
1981	15239.42	13166.23	9863.98	6449.18
1982	14162.96	11834.09	8906.84	5971.25
1983	14338.30	12287.09	9225.42	6151.63
1984	13724.16	11830.16	8869.21	5906.30
1985	13581.16	11755.70	8811.09	5832.40

Table A-20. Discounted Benefit Streams (Expressed in January, 1937 Dollars) for Female Workers and When the Rates of Discount Equal the Average Historical Growth Rate of Real Gross National Product.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	5519.47	4656.72	3793.97	2931.22
1941	5638.56	4757.53	3876.51	2995.48
1942	5197.11	4260.39	3572.39	2753.23
1943	4770.00	4024.12	3279.37	2533.50
1944	4780.12	4032.95	3285.78	2538.60
1945	4787.94	4039.82	3291.71	2543.59
1946	4782.59	4034.49	3287.48	2540.48
1947	4070.15	3433.72	2798.23	2161.80
1948	3765.85	3177.22	2588.60	1999.97
1949	3788.32	3196.40	2604.47	2012.55
1950	3932.62	3317.49	2703.24	2088.99
1951	5837.03	5310.80	4655.05	3724.04
1952	5364.59	4941.69	4377.82	3532.02
1953	6630.09	6240.09	4875.07	3221.44
1954	6688.83	6295.37	4918.26	3249.99
1955	7623.67	6583.00	5400.43	3256.02
1956	8159.71	6866.77	5589.60	3516.17
1957	8259.99	6920.12	5595.48	3646.58
1958	8016.59	6716.20	5430.59	3539.12
1959	8544.72	7145.15	5819.25	3756.73
1960	8657.51	7202.46	5820.17	3855.86
1961	8686.36	7238.63	5863.29	3908.86
1962	8810.80	7306.52	5873.87	4011.42
1963	8820.73	7268.28	5856.96	4022.25
1964	8944.66	7395.19	5916.16	4155.40
1965	9489.68	7848.71	6277.58	4413.16
1966	9299.28	7691.24	6151.62	4324.61
1967	9386.07	7750.21	6174.69	4377.93
1968	9277.77	7707.69	6040.28	4444.25
1969	12095.65	9970.74	7877.26	5695.77
1970	11737.98	9729.85	7661.96	5492.47
1971	12536.47	10363.63	8105.48	5841.63
1972	12390.84	10218.17	8028.95	5746.00
1973	14814.34	12209.50	9465.31	6812.24
1974	14150.05	11691.55	9039.35	6397.07
1975	15057.28	12291.29	9493.71	6637.48
1976	16047.67	12908.46	9989.55	6909.65
1977	17201.24	13739.82	10604.17	7264.92
1978	17534.73	14251.26	10891.52	7398.30
1979	17745.90	14552.06	11100.88	7469.92
1980	17520.53	14708.67	11127.99	7403.34
1981	18738.99	16189.71	12129.14	7930.16
1982	17434.68	14567.83	10964.37	7350.64
1983	17650.13	15125.13	11356.28	7572.52
1984	16902.94	14570.26	10923.49	7274.32
1985	16726.16	14477.97	10851.48	7183.01

Table A-21. Real Monthly Benefits (Expressed in January, 1937 Dollars) for Male Workers Retiring 1940-1985.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	41.68	35.16	28.65	22.13
1941	41.60	35.10	28.60	22.10
1942	37.81	31.00	25.99	20.03
1943	35.38	29.85	24.32	18.79
1944	34.68	29.26	23.84	18.42
1945	34.19	28.85	23.51	18.17
1946	33.76	28.48	23.21	17.93
1947	28.84	24.33	19.83	15.32
1948	26.40	22.27	18.15	14.02
1949	26.26	22.16	18.05	13.95
1950	27.06	22.83	18.60	14.37
1951	39.99	36.39	31.89	25.52
1952	36.45	33.58	29.75	24.00
1953	44.96	42.31	33.06	21.85
1954	44.45	41.84	32.68	21.60
1955	50.94	43.99	36.09	21.76
1956	54.42	45.79	37.28	23.45
1957	55.31	46.33	37.46	24.42
1958	53.43	44.77	36.20	23.59
1959	56.42	47.18	38.42	24.81
1960	57.14	47.53	38.41	25.45
1961	56.72	47.26	38.28	25.52
1962	56.81	47.42	38.03	25.82
1963	56.54	47.27	38.00	25.49
1964	56.08	46.50	37.39	25.53
1965	59.39	49.74	39.59	27.06
1966	58.70	48.79	38.84	26.54
1967	58.18	48.12	38.49	27.06
1968	57.12	47.39	37.67	27.03
1969	73.02	60.52	47.86	34.73
1970	70.70	58.63	46.15	33.75
1971	75.45	62.31	48.82	35.79
1972	74.04	61.37	47.76	34.64
1973	87.95	72.29	56.52	40.75
1974	82.98	68.36	53.37	37.80
1975	85.52	70.65	54.64	38.66
1976	92.17	75.13	58.04	40.24
1977	99.38	80.17	61.55	42.41
1978	103.73	84.31	64.43	43.77
1979	103.80	85.12	64.93	43.69
1980	103.52	86.91	65.75	43.74
1981	109.69	94.77	71.00	46.42
1982	101.49	84.80	63.82	42.79
1983	102.17	87.56	65.74	43.84
1984	97.31	83.88	62.89	41.88
1985	95.77	82.89	62.13	41.13

Table A-22. Real Monthly Benefits (Expressed in January, 1937 Dollars) for Female Workers Retiring 1940-1985.

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	41.68	35.16	28.65	22.13
1941	41.60	35.10	28.60	22.10
1942	37.81	31.00	25.99	20.03
1943	35.38	29.85	24.32	18.79
1944	34.68	29.26	23.84	18.42
1945	34.19	28.85	23.51	18.17
1946	33.76	28.48	23.21	17.93
1947	28.84	24.33	19.83	15.32
1948	26.40	22.27	18.15	14.02
1949	26.26	22.16	18.05	13.95
1950	27.06	22.83	18.60	14.37
1951	39.99	36.39	31.89	25.52
1952	36.45	33.58	29.75	24.00
1953	44.96	42.31	33.06	21.85
1954	44.45	41.84	32.68	21.60
1955	50.94	43.99	36.09	21.76
1956	54.42	45.79	37.28	23.45
1957	55.31	46.33	37.46	24.42
1958	53.43	44.77	36.20	23.59
1959	56.42	47.18	38.42	24.81
1960	57.14	47.53	38.41	25.45
1961	56.72	47.26	38.28	25.52
1962	57.75	47.89	38.50	26.29
1963	57.93	47.73	38.47	26.42
1964	57.90	47.87	38.30	26.90
1965	61.28	50.69	40.54	28.50
1966	60.11	49.72	39.76	27.95
1967	59.93	49.49	39.43	27.96
1968	59.19	49.17	38.53	28.35
1969	76.11	62.74	49.57	35.84
1970	73.16	60.64	47.76	34.23
1971	78.03	64.51	50.45	36.36
1972	76.99	63.49	49.89	35.70
1973	91.36	75.29	58.37	42.01
1974	86.09	71.14	55.00	38.92
1975	90.23	73.65	56.89	39.77
1976	95.92	77.16	59.71	41.30
1977	101.72	81.25	62.71	42.96
1978	103.73	84.31	64.43	43.77
1979	103.80	85.12	64.93	43.69
1980	103.52	86.91	65.75	43.74
1981	109.69	94.77	71.00	46.42
1982	101.49	84.80	63.82	42.79
1983	102.17	87.56	65.74	43.84
1984	97.31	83.88	62.89	41.88
1985	95.77	82.89	62.13	41.13

Table A-23. Nominal Monthly Benefits for Male Workers Retiring 1940-1985.^a

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	41.20	34.76	28.32	21.88
1941	41.60	35.10	28.60	22.10
1942	42.00	34.43	28.87	22.25
1943	42.40	35.77	29.15	22.52
1944	42.80	36.11	29.42	22.73
1945	43.20	36.45	29.70	22.95
1946	43.60	36.78	29.97	23.16
1947	44.00	37.12	30.25	23.37
1948	44.40	37.46	30.52	23.58
1949	44.80	37.80	30.80	23.80
1950	45.20	38.13	31.07	24.01
1951	72.10	65.60	57.50	46.00
1952	68.50	63.10	55.90	45.10
1953	85.00	80.00	62.50	41.30
1954	85.00	80.00	62.50	41.30
1955	96.70	83.50	68.50	41.30
1956	103.50	87.10	70.90	44.60
1957	108.50	90.90	73.50	47.90
1958	108.50	90.90	73.50	47.90
1959	116.00	97.00	79.00	51.00
1960	119.00	99.00	80.00	53.00
1961	120.00	100.00	81.00	54.00
1962	121.00	101.00	81.00	55.00
1963	122.00	102.00	82.00	55.00
1964	123.00	102.00	82.00	56.00
1965	131.70	110.30	87.80	60.00
1966	132.70	110.30	87.80	60.00
1967	135.90	112.40	89.90	63.20
1968	138.00	114.50	91.00	65.30
1969	184.60	153.00	121.00	87.80
1970	189.80	157.40	123.90	90.60
1971	213.10	176.00	137.90	101.10
1972	216.10	179.10	139.40	101.10
1973	266.10	218.70	171.00	123.30
1974	274.60	226.20	176.60	125.10
1975	316.30	261.30	202.10	143.00
1976	364.00	296.70	229.20	158.90
1977	412.70	332.90	255.60	176.10
1978	459.80	373.70	285.60	194.00
1979	503.40	412.80	314.90	211.90
1980	572.00	480.20	363.30	241.70
1981	677.00	584.90	438.20	286.50
1982	679.30	567.60	427.20	286.40
1983	709.50	608.00	456.50	304.40
1984	703.60	606.50	454.70	302.80
1985	717.20	620.80	465.30	308.00

^aData in this Table was derived especially for this study by Jack Spann, Reconsideration Specialist, The Social Security Program Service Center, Birmingham, Al.

Table A-24. Nominal Monthly Benefits for Female Workers Retiring 1940-1985.^a

Year of Retirement	Maximum Earner Case	75% Maximum Earner Case	50% Maximum Earner Case	25% Maximum Earner Case
1940	41.20	34.76	28.32	21.88
1941	41.60	35.10	28.60	22.10
1942	42.00	34.43	28.87	22.25
1943	42.40	35.77	29.15	22.52
1944	42.80	36.11	29.42	22.73
1945	43.20	36.45	29.70	22.95
1946	43.60	36.78	29.97	23.16
1947	44.00	37.12	30.25	23.37
1948	44.40	37.46	30.52	23.58
1949	44.80	37.80	30.80	23.80
1950	45.20	38.13	31.07	24.01
1951	72.10	65.60	57.50	46.00
1952	68.50	63.10	55.90	45.10
1953	85.00	80.00	62.50	41.30
1954	85.00	80.00	62.50	41.30
1955	96.70	83.50	68.50	41.30
1956	103.50	87.10	70.90	44.60
1957	108.50	90.90	73.50	47.90
1958	108.50	90.90	73.50	47.90
1959	116.00	97.00	79.00	51.00
1960	119.00	99.00	80.00	53.00
1961	120.00	100.00	81.00	54.00
1962	123.00	102.00	82.00	56.00
1963	125.00	103.00	83.00	57.00
1964	127.00	105.00	84.00	59.00
1965	135.90	112.40	89.90	63.20
1966	135.90	112.40	89.90	63.20
1967	140.00	115.60	92.10	65.30
1968	143.00	118.80	93.10	68.50
1969	192.40	158.60	125.30	90.60
1970	196.40	162.80	128.20	91.90
1971	220.40	182.20	142.50	102.70
1972	224.70	185.30	145.60	104.20
1973	276.40	227.80	176.60	127.10
1974	284.90	235.40	182.00	128.80
1975	333.70	272.40	210.40	147.10
1976	378.80	304.70	235.80	163.10
1977	422.40	337.40	260.40	178.40
1978	459.80	373.70	285.60	194.00
1979	503.40	412.80	314.90	211.90
1980	572.00	480.20	363.30	241.70
1981	677.00	584.90	438.20	286.50
1982	679.30	567.60	427.20	286.40
1983	709.50	608.00	456.50	304.40
1984	703.60	606.50	454.70	302.80
1985	717.20	620.80	465.30	308.00

^aData in this Table was derived especially for this study by Jack Spann, Reconsideration Specialist, The Social Security Program Service Center, Birmingham, Al.

Table A-25. Consumer Price Index for Each January, 1940-1985.^a

Year	Value
1940	0.989
1941	1.000
1942	1.111
1943	1.198
1944	1.234
1945	1.263
1946	1.291
1947	1.525
1948	1.682
1949	1.706
1950	1.670
1951	1.803
1952	1.879
1953	1.891
1954	1.912
1955	1.898
1956	1.902
1957	1.962
1958	2.031
1959	2.056
1960	2.083
1961	2.116
1962	2.130
1963	2.158
1964	2.193
1965	2.218
1966	2.261
1967	2.336
1968	2.416
1969	2.528
1970	2.684
1971	2.824
1972	2.919
1973	3.025
1974	3.309
1975	3.698
1976	3.949
1977	4.153
1978	4.433
1979	4.850
1980	5.525
1981	6.172
1982	6.693
1983	6.944
1984	7.230
1985	7.489

^aIbbotson Associates, Stocks, Bonds, Bills, and Inflation: 1987 Yearbook, (Chicago, 1987), p. 145.

Table A-26. Annuity Factors for Men and Women Attaining Age 65 in 1940-1985, Derived Assuming Expected Risk-free Yields Are Forecasted by the Average Historical Real Yield on One-Month Treasury Bills.

Year	Men	Women
1940	141.00	158.46
1941	143.91	162.99
1942	146.48	165.77
1943	143.21	161.94
1944	147.41	166.35
1945	149.27	169.60
1946	151.95	172.03
1947	149.39	171.22
1948	150.20	173.54
1949	151.48	175.97
1950	151.37	177.59
1951	151.72	178.52
1952	153.23	180.37
1953	152.76	180.83
1954	156.13	185.45
1955	154.51	184.18
1956	154.04	184.65
1957	152.30	183.72
1958	152.76	184.76
1959	154.27	186.96
1960	152.53	187.07
1961	154.51	189.61
1962	152.76	188.69
1963	150.67	188.23
1964	153.58	191.69
1965	152.65	192.27
1966	151.95	192.04
1967	153.69	195.03
1968	151.25	195.26
1969	153.81	198.72
1970	155.20	201.14
1971	155.09	201.49
1972	154.62	201.95
1973	155.79	203.90
1974	159.16	207.47
1975	161.71	211.61
1976	162.29	212.30
1977	164.15	215.29
1978	164.61	215.17
1979	167.28	218.38
1980	165.66	215.52
1981	167.98	218.16
1982	168.90	219.76
1983	170.06	221.37
1984	171.11	222.97
1985	172.26	224.58

Table A-27. Annuity Factors for Men and Women Attaining Age 65 in 1940-1985, Derived Assuming Expected Risk-free Yields Are Forecasted by the Average Historical Growth Rate of Real Gross National Product.

Year	Men	Women
1940	120.13	132.43
1941	122.22	135.54
1942	124.05	137.44
1943	121.72	134.83
1944	124.71	137.83
1945	126.02	140.02
1946	127.91	141.65
1947	126.11	141.11
1948	126.68	142.66
1949	127.58	144.27
1950	127.50	145.34
1951	127.74	145.95
1952	128.80	147.16
1953	128.48	147.47
1954	130.83	150.48
1955	129.69	149.65
1956	129.37	149.95
1957	128.15	149.35
1958	128.48	150.03
1959	129.53	151.45
1960	128.31	151.52
1961	129.69	153.15
1962	128.48	152.56
1963	127.01	152.26
1964	129.05	154.48
1965	128.40	154.85
1966	127.91	154.70
1967	129.13	156.61
1968	127.42	156.75
1969	129.21	158.93
1970	130.18	160.44
1971	130.10	160.65
1972	129.78	160.94
1973	130.58	162.16
1974	132.91	164.36
1975	134.67	166.88
1976	135.07	167.30
1977	136.33	169.11
1978	136.65	169.04
1979	138.46	170.97
1980	137.36	169.25
1981	138.93	170.83
1982	139.55	171.79
1983	140.33	172.75
1984	141.03	173.70
1985	141.81	174.64

Table A-28. Ex Ante Discount Rates Applicable for Each Month in the Years, 1940-1985, Derived by Assuming That the Average Historical Real Yield on One-Month Treasury Bills Can Be Used to Forecast Real Yields on the Risk-free Asset.^a

Year	Forecasted Rates
1940	0.0002
1941	0.0002
1942	0.0002
1943	0.0002
1944	0.0002
1945	0.0002
1946	0.0002
1947	0.0002
1948	0.0002
1949	0.0002
1950	0.0002
1951	0.0002
1952	0.0002
1953	0.0002
1954	0.0002
1955	0.0002
1956	0.0002
1957	0.0002
1958	0.0002
1959	0.0002
1960	0.0002
1961	0.0002
1962	0.0002
1963	0.0002
1964	0.0002
1965	0.0002
1966	0.0002
1967	0.0002
1968	0.0002
1969	0.0002
1970	0.0002
1971	0.0002
1972	0.0002
1973	0.0002
1974	0.0002
1975	0.0002
1976	0.0002
1977	0.0002
1978	0.0002
1979	0.0002
1980	0.0002
1981	0.0002
1982	0.0002
1983	0.0002
1984	0.0002
1985	0.0002

^aThe average historical real yield on Treasury bills employed in this research was .2% per year, the value calculated by Ibbotson Associates. See Ibbotson Associates, Stocks, Bonds, Bills, and Inflation: 1985 Yearbook, (Chicago, 1985), p. 76.

Table A-29. Ex Ante Discount Rates Applicable for Each Month in the Years, 1940-1985, Derived by Assuming That the Average Historical Growth Rate of Real Gross National Product Can Be Used to Forecast Real Yields on the Risk-free Asset.^a

Year	Forecasted Rates
1940	0.0025
1941	0.0025
1942	0.0025
1943	0.0025
1944	0.0025
1945	0.0025
1946	0.0025
1947	0.0025
1948	0.0025
1949	0.0025
1950	0.0025
1951	0.0025
1952	0.0025
1953	0.0025
1954	0.0025
1955	0.0025
1956	0.0025
1957	0.0025
1958	0.0025
1959	0.0025
1960	0.0025
1961	0.0025
1962	0.0025
1963	0.0025
1964	0.0025
1965	0.0025
1966	0.0025
1967	0.0025
1968	0.0025
1969	0.0025
1970	0.0025
1971	0.0025
1972	0.0025
1973	0.0025
1974	0.0025
1975	0.0025
1976	0.0025
1977	0.0025
1978	0.0025
1979	0.0025
1980	0.0025
1981	0.0025
1982	0.0025
1983	0.0025
1984	0.0025
1985	0.0025

^aThe average historical real growth rate of gross national product employed in this research was 3% per year, the same value employed by Ozawa in her research. See Martha N. Ozawa, Social Security, (New York, 1975), pp. 7-8.

Table A-30. Life Expectancy Beyond Age 65 (in Months) for Men and Women Attaining Age 65 in 1940-1985.^a

<u>Year of Age 65 Attainment</u>	<u>Men</u>	<u>Women</u>
1940	143	161
1941	146	166
1942	149	169
1943	145	165
1944	150	169
1945	152	173
1946	154	175
1947	152	174
1948	153	177
1949	154	179
1950	154	181
1951	154	182
1952	156	184
1953	155	184
1954	159	189
1955	157	188
1956	156	188
1957	155	187
1958	155	188
1959	157	191
1960	155	191
1961	157	193
1962	155	192
1963	153	192
1964	156	195
1965	155	196
1966	154	196
1967	156	199
1968	154	199
1969	156	203
1970	158	205
1971	158	206
1972	157	206
1973	158	208
1974	162	212
1975	164	216
1976	165	217
1977	167	220
1978	167	220
1979	170	223
1980	168	220
1981	171	223
1982	172	225
1983	173	226
1984	174	228
1985	175	230

^aU. S. Department of Health and Human Services, Social Security Administration, Office of the Actuary, Life Tables for the United States: 1900-2050, Actuarial Study No. 89 (Washington D. C., 1983), pp. 70-71.

VITA

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