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Report of the

Consultant Panel on Social Security

to the

Congressional Research Service

Prepared for the Use of the

Committee on Finance

of the

U.S. Senate

and the

Committee on Ways and Means

of the

U.S. House of Representatives

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Letter of Submittal

CAMBRIDGE, MASS., *April 5, 1976.*

MR. NORMAN BECKMAN, *Acting Director,*
United States Congressional
Research Service,
Washington, D.C.

DEAR MR. BECKMAN: The Consultant Panel on Social Security appointed by you in April, 1975, is honored to submit our report for transmission to the U.S. Senate Committee on Finance and U.S. House Committee on Ways and Means.

The members of this Panel are unanimous in the findings and recommendations therein. We believe that we have given sufficient study to the essential questions so we are confident that our observations justify attention and action by the U.S. Congress.

Respectfully yours,

WILLIAM HSIAO, *Chairman.*

Letter of Transmittal

THE LIBRARY OF CONGRESS,
CONGRESSIONAL RESEARCH SERVICE,
Washington, D.C., April 22, 1976.

Hon. RUSSELL B. LONG,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: With this letter I am enclosing a copy of a study, "Report of the Consultant Panel on Social Security", which was prepared at your request by a panel of consultants under contract to the Congressional Research Service.

In response to your request of last February for a study of various ways in which the social security benefit structure might be revised and of the effects of such revision on beneficiaries and program costs, the Congressional Research Service engaged the services of William C. L. Hsiao, Ph.D., F.S.A., as chairman of a team of actuaries and economists. Under the terms of the Service's contract with Dr. Hsiao, he was responsible for "organizing a group of consultants including actuaries and an economist to develop and analyze various alternatives formulae for the calculation of future benefit amounts under an actuarially sound" social security program. The other members of the group were Peter A. Diamond, Ph.D., James C. Hickman, Ph.D., F.S.A., and Ernest J. Moorhead, F.S.A.

In keeping with your desire that the staff of the two Committees be kept informed of the activities of the consultant group, several meetings were held among the consultant group, Committee staff, and CRS staff. At these meetings the development, structure, and content of the report were discussed. As suggested in these subsequent meetings and in order to enhance the usefulness of the report as a possible focus for policy deliberations, it is presented in terms of alternatives and a specific set of recommendations by the panel of consultants. However, the use of this recommendation format should not be construed as suggesting support for the course of action recommended by the panel by either the Committees, Committee staff, or the Congressional Research Service. As you know, the Congressional Research Service neither makes nor advocates policy recommendations.

We are happy that we could be of assistance to the committees in this phase of the review of the Social Security program. As you know, the staff of the Service is available to provide whatever additional assistance you may desire in your search for solutions to the many complex problems that now confront the Social Security program.

Sincerely yours,

NORMAN BECKMAN, *Acting Director.*

Staff note: The text of the report as printed in this document contains some modifications made by the consultant group subsequent to the date the report was sent to the Committees by the Congressional Research Service. These changes were made to take into account information in the 1976 Report to the Congress of the Board of Trustees of the Social Security Trust Funds. This report was not submitted by the Trustees until May 1976.

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Acknowledgements

The Panel expresses its sincere appreciation to the Social Security Administration whose full cooperation and assistance made this study possible and to many individuals who have assisted our work through these months of study and report preparation. It is impossible to name everybody whose help and criticism have thrown light upon the questions we have been considering. Perhaps without slight to the others we may be permitted to direct special gratitude to the following:

Frank L. Griffin, Jr., F.S.A., retired actuary, Gardnerville, Nev., who was a panel member during the first months of this study and who continued to take close and helpful interest in the deliberations.

Thomas Staples, Special Assistant to the Assistant Commissioner for Research and Statistics, Social Security Administration, who coordinated the tasks of furnishing large amounts of information and calculation that we requested.

Aaron Prero, Herman Grundmann, Barry Bye, Frederick Scheuren, H. Lock Oh, John Spencer and Virginia Reno of the Office of Research and Statistics, Social Security Administration, who completed the statistical analysis and promptly provided the large amounts of data to us.

A. Haeworth Robertson, F.S.A., Chief Actuary; Francisco Bayo, A.S.A., Deputy Chief Actuary; William Ritchie, Steven F. McKay, and other members of the staff of the Office of the Actuary, Social Security Administration, who consulted with us and furnished essential calculations and data.

Mary E. Ross and Letitia D. Passig of the Office of Program Evaluation and Planning, Social Security Administration, who educated us on the administrative complexities of the program and gave us helpful comments.

Robert J. Myers, F.S.A.; C. L. Trowbridge, F.S.A.; and Howard Young, F.S.A., who freely gave us the benefit of their knowledge and experience in this field.

Alicia Munnell, who discussed complex questions with us and permitted us to make extensive use of her to-be-published manuscript, *The Future of Social Security*.

Richard Anderson, Yves Balcer, Roger Gordon, and Jerry Hausman of Massachusetts Institute of Technology, who participated with Peter A. Diamond in the simulation project and contributed in other ways also.

Thomas McInteer, Wake Forest University, who developed and employed a computer program to illustrate indexed benefit formulas.

Carol Weisberg, who greatly eased the pain of preparing this report. Her always cheerful cooperation in this enterprise and her secretarial skills enabled us to complete the project on schedule.

William Kelley and Fred Arner, professional staff members of the U.S. House Committee on Ways and Means; Michael Stern, staff director, and Joseph Humphreys, professional staff member, of the U.S. Senate Committee on Finance; Frank Crowley of the U.S. Congressional Research Service for consultations and helpful interest in this study.

REPORT OF THE CONSULTANT PANEL ON SOCIAL SECURITY

Chapter 1.—Summary and Recommendations

PREAMBLE

Three independent reports[1] submitted to the U.S. Congress have disclosed the insufficiency of scheduled taxes to cover expected outlays of the social security cash program (OASDI). In addition, and of equal importance, these reports found that the program's benefit structure suffers from a serious technical flaw which produces benefits that respond erratically to fluctuations in economic conditions. This flaw endangers not only the financial security promised to future beneficiaries, but also the financial soundness of the entire social security system. In response to these findings, Congressman Al Ullman, Chairman of the House Committee on Ways and Means, and Senator Russell B. Long, Chairman of the Senate Committee on Finance, requested the U.S. Congressional Research Service:

> to engage a group of outside consultants to examine the various ways in which the benefit structure could be revised to correct the problem of any overreaction to changes in price levels. Such an examination should include an analysis of the impact which such revisions of the benefit structure would have on the financing of the program and on the benefits actually payable to various categories of beneficiaries.

These requests were complied with in April, 1975, by the appointment of a panel of actuaries and economists. The Panel's membership now is:

Peter A. Diamond, Ph.D., Professor of Economics, Massachusetts Institute of Technology;

James C. Hickman, F.S.A., M.A.A.A., Ph.D., Professor of Business and Statistics, University of Wisconsin;

Ernest J. Moorhead, F.S.A., M.A.A.A., retired actuary, Winston-Salem, North Carolina; and

William C. Hsiao, F.S.A., M.A.A.A., Ph.D., Associate Professor of Economics, Harvard University (Project Director).

The Panel's tasks were (1) to develop and study alternative benefit formulas designed to solve the system's problems, thus re-establishing justifiable public confidence in OASDI, and (2) to estimate the costs and evaluate methods of financing the program.

MAJOR ISSUES

1. *Erratic benefits*—The present social security benefit formula, legislated in 1972, adjusts benefits automatically to reflect changes in the Consumer Price Index. These automatic provisions cause both benefits and taxable earnings base to rise as average wages under covered employment increase. The Panel approves the concept of automatic adjustments. However, the method now employed suffers from a flaw of overindexing whose probable effect will be disproportionate benefit increases for future beneficiaries in relation to price and wage increases. The outlook is for benefits that will be erratic and even capricious in terms of historical precedents. These tendencies are accentuated during periods of high inflation.

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[1] These three reports are:

1974 Annual Report of The Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds (May, 1974);

Report of the Panel on Social Security Financing to the Committee on Finance, United States Senate (Feb., 1975), and

Reports of The Quadrennial Advisory Council on Social Security (March, 1975)

2. *Serious financial deficit*—The OASDI program faces large financial deficits over both the short- and long-range.

Recent heavy inflation and increase in unemployment have created the short-range difficulties. Payroll tax revenues had not kept pace with benefit payments. These payments have increased because of (1) more claimants, and (2) operation of the automatic adjustments.

The size of the long-range deficit is attributable also to expected increase in the ratio of OASDI beneficiaries to working contributors, and to the flaw in the automatic provisions.

Perhaps the most important lesson learned from the financial difficulties now facing the OASDI program is that an element of flexibility must be built into its design. Abrupt changes in benefits and supporting taxes must be avoided. In our constantly changing society and economy, public interest can best be served by a system with built-in margins that will permit measured response to the needs of an uncertain future.

It has been pointed out that on reasonable economic and demographic assumptions the payroll tax rates needed to finance benefits payable in the first half of the next century will rise to more than double present rates. An issue that should not be overlooked is what future tax rates will be needed to finance any proposal offered as an improved benefit structure. The Panel believes that future generations of workers should not be committed in advance to materially rising tax rates.

3. *Appropriate type of benefit formula*—There are several quite different types of benefit formula that warrant consideration for a social insurance program; among these are: a flat benefit; a money-purchase plan; a final-average, or related High-5, etc., type; a wage-indexed formula; and a price-indexed formula. The Panel considered all these possibilities in the light of the general criteria that are listed in Chapter 2. The flat benefit and money-purchase types are too far removed from the existing type to be feasible. Comparative analyses of the other types are set forth in Chapter 3.

4. *Spouse's benefit*—The benefit awarded at retirement to a worker with a spouse who has no earnings record when both are over age 65 is 150 percent of the benefit paid to an unmarried worker who has made identical contributions. Furthermore, moderate past earnings by the spouse create no additional benefits. This benefit design, doubtless appropriate during the early years of the OASDI program when fewer than 15 percent of married women were in the labor force, becomes less and less so as more and more married couples have both spouses earning OASDI benefits. This issue goes beyond simply providing more equitable treatment between one- and two-worker families. The spouse benefit also magnifies the irrationality of the benefit structure. Inevitably, a significant number of families will receive tax-free retirement benefits greater than their pre-retirement earnings net after taxes and the costs of generating those earnings.

5. *Effects of other government programs*—Two recent pieces of Federal legislation have had significant impacts on the OASDI program and its financing: the Supplemental Security Income Program and the Earned Income Tax Credit provision.

A. Supplemental Security Income Program (SSI)—The original Social Security Act of 1935 offered economic security to the aged through two programs: an earnings-related old-age income program and a system of Federal matching grants to State old-age assistance programs. The assistance was meant to provide subsistence to all recipients. The earnings-related program (OASI) was designed to be a second tier of coverage to meet basic needs above subsistence. But a serious problem with the States' old-age assistance programs was the variety in eligibility standards and payment levels. The SSI program was enacted in 1972 to provide uniform Federal means-tested benefits, thus assuring a basic subsistence income to all the aged. Appropriately, this program is financed from general revenues; the outlay for fiscal year 1976 is estimated at $5.2 billion.

Future OASDI benefit levels must take the SSI program into consideration if duplications of efforts and expenditures are to be avoided.

B. Earned Income Tax Credit—Criticism has been directed at the allegedly regressive nature of the OASDI payroll tax. If the tax is appraised in isolation, then it is indeed regressive, but this is taking an excessively narrow view. The nature of the benefit formula causes low-income workers to receive benefits that are proportionately higher than those of high-income workers.[1] If the taxes and benefits are examined together, then the whole system is seen to be progressive. Even when attention is confined to the tax levy upon low-income workers, it seems that the more appropriate frame of reference is the sum of all taxes rather than each tax considered by itself.

Enactment of the Earned Income Tax Credit provision constitutes a useful new tool for modifying the taxes and resulting income of the poor. The total expenditure in fiscal year 1976 for this provision is estimated at $1.5 billion. The financing of the OASDI system should be coordinated with this and other tax decisions affecting low-income workers.

MAJOR RECOMMENDATIONS

In arriving at its recommendations, the Panel has been acutely aware of the financial needs of retired persons, both now and in the future. But we recognize that every increase in benefits must be financed by an increase in taxes—whether from payroll or from general government revenue. We have tried, therefore, to strike a reasonable balance between benefits and the costs of providing them.

The Panel was guided also by the long-established principles that Congress has set for the earnings-related OASDI: namely, the principles of social adequacy and individual equity applying to both benefits and the supporting taxes. Furthermore, we recognize that the social security system has created strong expectations among its participants that they will receive retirement benefits that are reasonably related to their lifetime earnings. The OASDI must seek to fulfill these expectations.

A worker's willingness to pay the required taxes depends largely on his belief that his expectations will be realized. Yet, if these benefit expectations are unreasonably high, then the program will encounter financial difficulty. To operate the system successfully in the face of unpredictable social, demographic, and economic changes, requires flexibility that the system now lacks.

1. *Benefit formula*—The Panel recommends that:

   (a) as under present law, retirement benefits continue to be increased automatically after retirement in proportion to the Consumer Price Index;

   (b) benefits for future retirees be computed using earnings that have been indexed in proportion to the change in price levels during the earnings-averaging period;

   (c) the progressively lengthening averaging period of present law be retained;

   (d) the minimum benefit provision under OASDI be eliminated; and

   (e) future Congresses determine the extent to which benefits can be increased beyond the levels reached automatically, in the light of needs of the beneficiaries and willingness of the workers to pay the necessary taxes.

The effect of these recommendations would be:

—Benefits to workers already retired would be protected against erosion from inflation.

—The purchasing power of benefits for future retirees would tend to increase even without future congressional action and can be further increased by congressional action. However, in the absence of such action, the benefit

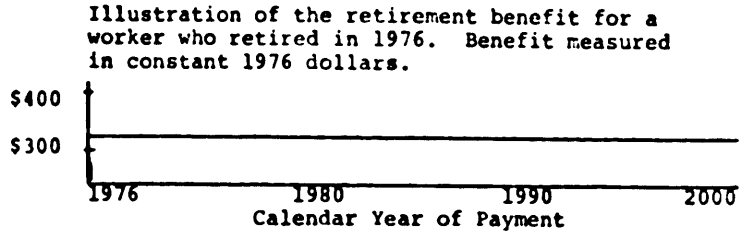
[1] For example, contrast the monthly benefits upon retirement at age 65 in early 1976 of three workers whose average monthly earnings were $600, $300 and $150, respectively. For the $600 case, the benefit is $371.50; for the $300, it is $231.60; for the $150, $161.10.

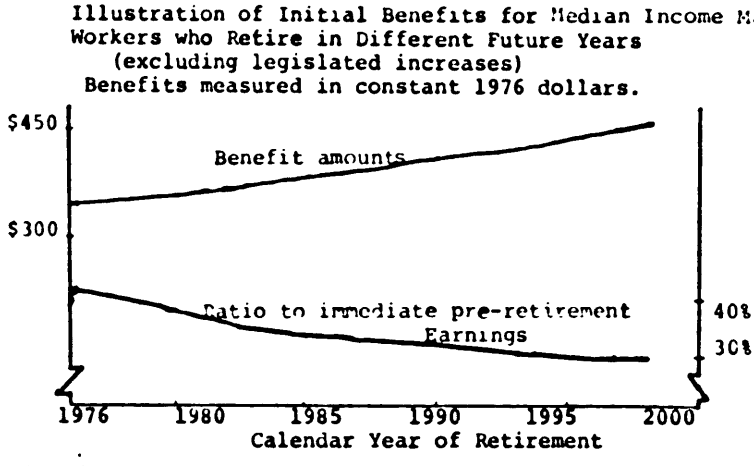
measured in relation to worker's pre-retirement earnings would decline.[8] The benefit patterns, in the absence of legislated increases, under the recommended formula are illustrated below.

—Workers would receive more equitable benefits in relation to their contributions

—It would be left to future generations to decide what benefit increases are appropriate and what tax rates to finance them are acceptable, and to implement those decisions through congressional actions

—Windfall benefits to people with short earnings records under the social security system (e.g., government employees who develop a period of covered employment under OASDI) would be progressively reduced.





(It should be noted that the first of these two charts portrays the situation according to calendar year of benefit payment, the second according to calendar year of retirement.)

2. *Financing*—The Panel recommends that:

(a) the system continue to be financed by payroll taxes, not from general government revenues;

(b) the ceiling on wages subject to payroll tax be moderately increased, and then maintained at a point at which the entire earnings of approximately 90 percent of all workers are covered. In 1977, the estimated maximum would be $18,900 instead of the $16,500 expected under present law. This maximum would continue to increase automatically in proportion to increases in covered wages, subject to revisions from time to time to maintain the 90 percent benchmark;

(c) the combined employer and employee payroll tax rate be increased by 0.4 percent (i.e. 0.2 percent each); and

(d) the tax rate for the self-employed, for both OASDI and HI, be increased to 75 percent of the combined rate for employees and employers.

[8] Note that this is *not* a benefit reduction for those already retired. Nor is it a reduction in the purchasing power of benefits for any generation of retired people compared with corresponding people of previous generations.

The effect of these financing recommendations, in conjunction with the benefit structure recommendations, would be:

—Under economic and demographic assumptions that appear to be within a reasonable range, the tax rates needed to finance promised benefits would remain close to those initially recommended by this Panel. (Tables at the end of this chapter illustrate these rates.)

—Congress would have leeway to finance additional benefits out of acceptable tax increases.

—The tax rate for the self-employed would return to the level relative to the combined employer-employee tax rate that existed in the past.

The emphasis of this Panel's proposal is upon congressional control rather than upon maintenance of approximately today's tax rate. Even if Congress believes that workers at the turn of the century will be willing to pay a combined payroll tax rate substantially higher than the current tax rate, we consider it undesirable to incorporate that belief into the system at the present time, thereby causing rigidity. As time passes Congress can raise benefit levels and the corresponding taxes at its discretion.

The Panel has concluded that the use of general government revenue to finance the OASDI program is inappropriate. Our reasons are:

—General revenues are more properly used to support needs-related old-age income programs and general tax relief to low-income workers.

—Needs of elderly persons other than for income maintenance—such as housing, long-term care, and social services—appear to have more urgent claims on general revenues.

—General-revenue financing of the OASDI program would weaken the earnings-related nature of the program. It could even jeopardize the long-range stability of the entire social security system, thwarting citizen expectations of retirement income protection.

3. *Spouse's benefit*—The Panel recommends abandonment of the present schedule of spouse benefits for future retired workers. We recommend instead averaging the earnings of the husband and wife for determining benefits to members of both one-worker and two-worker families. This procedure would result in more equitable treatment in relating benefits to contributions.

OTHER RECOMMENDATIONS

1. *Retirement test*—Effects created by the retirement test are largely unknown; so are the forces responsible for the present large number of early retirements. The Panel recommends that Congress use OASDI Trust Funds to finance a study of the economic impact of the retirement test. The study would apply different retirement tests to different samples of workers. Resulting increased knowledge of the factors affecting retirement decisions could aid Congress in making sound changes.

This Panel supports in the interim the removal of the monthly earnings test as part of the retirement test.

2. *Universal coverage*—The Panel recommends that social security coverage be made universal. In particular, we find no reason for the exclusion of federal government employees. The present system produces many windfall benefits to those who are covered by other systems, but who nevertheless qualify for social security benefits by reason of limited periods of covered employment.

FUTURE TAX RATES

It is important to distinguish between the tax implications of this Panel's recommendation and the tax implication of other proposals currently presented to Congress. It is also essential that comparisons among proposals all be based upon the same or similar economic and demographic assumptions. A third essential is that each proposal be tested to determine its sensitivity to variations in assumed

future conditions. The major causes of such sensitivity are the rate of price increase and the relation of the rate of price increase to the concurrent rate of wage increase.

There follow three tables. The first table illustrates future tax rates on the assumption that wage growth will be 5¾ percent per year and prices will increase 4 percent per year, both compounded annually. These are the intermediate assumptions employed in illustrating other proposals made to Congress, including the "Social Security Benefit Indexing Act" proposed by President Ford on June 17, 1976. The President's proposal, however, provides no remedy from the long-range financial deficits of the program. It leaves a significant actuarial deficit in the financing of the OASDI system.

The second table shows the stability of the tax rates needed to finance promised benefits under this Panel's recommendation—a stability not enjoyed by other major recommendations that Congress is considering.

The third table illustrates the steadily increasing purchasing power of benefits promised to different generations of retired people under this Panel's recommendation.

TABLE I ESTIMATED EXPENDITURES UNDER THE SET OF INTERMEDIATE ASSUMPTIONS ADOPTED BY THE 1976 BOARD OF TRUSTEES FOR THE OASDI PROGRAM[1]

[In percent]

		This panel's recommendation[2]		President Ford's proposal[3]	
Calendar year	Tax rate scheduled under present law	Expenditures as a percent of taxable payroll	Tax rates recommended	Expenditures as a percent of taxable payroll	Tax rates recommended
1980	9.9	10.6	10.3	10.7	10.5
1990	9.9	10.5	10.3	11.8	10.5
2000	9.9	10.0	10.3	12.4	10.5
2010	9.9	10.0	10.3	13.4	10.5
2020	11.9	11.5	10.3	16.5	12.5
2030	11.9	12.5	10.3	18.9	12.5
2040	11.9	11.9	10.3	18.9	12.5
2050	11.9	11.3	10.3	18.8	12.5

Average over next 75 year period	Panel's recommendation	President Ford's proposal
(1) Expenditures	11.0	15.0
(2) Tax rate	10.3	11.6
Excess of (1) over (2), often called actuarial balance[4]	−0.7	−3.4

[1] Each 1 percent of taxable payroll equals $8 billion in 1977. This set of intermediate assumptions is explained in the 1976 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Trust Funds, May 1976, at is labelled "Alternative II" in that report.

[2] The estimated expenditures assume adoption of the maximum taxable earnings base recommended by the Panel. In 1977, this maximum would be $18,900 instead of the $16,500 expected under present law.

[3] These figures are applicable to the wage-indexing formula proposed by President Ford in June, 1976. The formula for 1978 retirement at age 65 is 91% of the first $175 of average indexed monthly earnings, plus 33% of the next $875, plus 17% of the excess over $1,050. For retirements after 1978 the dollar figures in the formula are wage-indexed upwards. President Ford's proposal recognizes that it does not provide adequate financing for the program beyond the next several years. It proposes to make further studies and then recommend corrective actions.

[4] Under these particular assumptions, the tax rate recommended by this Panel is shown to be insufficient, by an average of 0.7% per year, to cover expenditures over the next 75-year period. These estimates, however, are based on the intermediate assumptions employed in the 1976 OASDI Trustees Report. The Panel considers these assumptions overly pessimistic in two elements, viz., wage increase rates and fertility rates. If the assumptions preferred by this Panel—a 6% annual increase in wage rates, and ultimately a 2.1% fertility rate—are used, the insufficiency is erased.

TABLE 2 TAX RATE NEEDED TO SUPPORT THIS PANEL'S BENEFIT RECOMMENDATIONS UNDER SEVERAL WAGE & PRICE INCREASE ASSUMPTIONS

	If excess of wage over price growth is 2 percent		If excess of wage over growth is 1 percent	
Calendar year	5-3	7-5	5-4	6-5
1980	106	106	107	107
1990	104	103	114	113
2000	96	96	114	113
2010	95	95	120	119
2020	108	108	142	142
2030	117	117	158	158
2040	110	110	153	152
2050	104	104	148	147
Average pay as you go	105	105	131	131

Note – Assumptions other than for wage and price increase rates used in deriving figures for table 2 are the intermediate assumptions in the 1976 OASDI Trustees Report

TABLE 3 PURCHASING POWER (I E , VALUE IN 1976 DOLLARS) OF BENEFITS PROMISED TO WORKERS WHO RETIRE AT AGE 65 AT DIFFERENT TIMES THIS PANEL'S BENEFIT RECOMMENDATION (SEE CHAPTER 3 FOR PARTICULARS)

	Calendar Year of Retirement				
Earnings during averaging period	1976	1983	1990	1997	2003
Median of year round full time workers					
Men	$341	$375	$408	$450	$511
Women	281	293	312	327	357
Workers earning taxable maximums in all years	352	399	438	489	563

A COMPARISON OF THE PANEL'S RECOMMENDED PRICE-INDEXING METHOD AND WAGE-INDEXING METHOD PROPOSED BY PRESIDENT FORD IN JUNE 1976.

There is widespread agreement that the present overindexing of benefits must be corrected. Two major alternatives have been proposed: the price-indexing method recommended by the Panel and the wage-indexing method proposed by President Ford. These grant identical treatment to those already receiving benefits, both guarantee that benefits will keep pace with increases in the Consumer Price Index.

However these two approaches differ in the computation of initial benefits for workers who retire in the future. The Panel's price-indexing method would protect future retirees against inflation through automatic adjustments in the benefit formula used to compute initial retirement benefits. In other words, the benefits for workers retiring in the future years would be automatically increased to keep pace with inflation. In addition, their initial benefits would tend to increase even further when real wages increase. However, the initial benefits, measured as a percent of immediate pre-retirement earnings would decline in the absence of legislated increases.

On the other hand, the wage-indexing method proposed by President Ford would provide an initial retirement benefit that replaces approximately the same ratio of each worker's pre-retirement wages as applies for a worker who retires in 1976.

The two different approaches of correcting the overindexing produce very different outcomes in:

1. *Flexibility and congressional control*—These two methods produce different promises of benefits to workers retiring in the future. The price-indexing method guarantees a moderate benefit that compares favorably with that for a worker who

has previously retired and preserves a greater degree of control and flexibility for Congress to increase the benefit in the future. The price-indexing method would guarantee a benefit amount that is protected against inflation. Moreover, the benefits for future retirees would tend to increase even without future congressional action because of the rise in workers' productivity. Congress can further raise the benefits in light of the needs of retired people and the economic, social, and demographic conditions prevailing at that time.

The wage-indexing method, on the other hand, would make benefit levels fully automatic. These automatic adjustment provisions establish benefits at a higher level and thus leave less financial flexibility for congressional control. Belief in the achievability of these promised higher levels of benefits without large tax increases requires a strong faith in the reliability of forecasts about future economic and demographic conditions.

2. *Benefits promised and incidence of their costs*—Under the pay-as-you-go method of financing social security, taxes paid by each generation of workers are immediately paid out to people already retired. The retirement benefits of current workers will when the time comes, be financed by the payroll tax contributions collected from the next generation of workers. Therefore whether the expectations of current workers can be realized depends upon whether the next generation of workers is willing to pay the required taxes. If the promised benefits are unreasonably high, the program will encounter financial difficulties.

The two alternatives proposed to correct overindexing promise different benefits. Correspondingly, their respective costs are very different. The wage-indexing method proposed by President Ford may require a future generation of workers to pay a payroll tax that is 70 percent higher than the present level. This Panel gravely doubts the fairness and wisdom of now promising benefits at such a level that we must commit our sons and daughters to a higher tax rate than we ourselves are willing to pay.

Social security is a long-term program. Its stability and financial soundness depend on the Congress taking a long-term view. Long-range projections are inherently quite complicated and based on assumptions. Some important elements that determine the costs are more predictable than others, some of the factors are close to being unpredictable. Nevertheless, the projections provide valuable indications and ranges of future costs and financing requirements.

In the next table are shown cost comparisons using the intermediate assumptions of the 1976 Trustees Report. The price-indexing method produces expenditures that are relatively level as a percentage of taxable payroll. But the wage-indexing method produces expenditures that require substantially greater tax payments from future generations of workers.

TABLE 4 COMPARISON OF OASDI LONG RANGE COST

[In percent]

	Expenditures as percent of taxable payroll[1]	
	Price indexing method using the Panel's formula	Wage-indexing method using President Ford's formula
1976	10.8	10.8
1980	10.6	10.7
1990	10.5	11.8
2000	10.0	12.4
2010	10.0	13.4
2020	11.5	16.5
2030	12.5	18.9
2040	11.9	18.9
2050	11.3	16.8

[1] 1 percent of taxable payroll equals $8 billion in 1977

3. *Unequal treatment of people retiring at different times*—The price-indexing formula provides that retirement benefits will be protected against inflation. It leaves financial flexibility for Congress to give whatever periodic general benefit increases that appear reasonable from time to time for everyone: currently retired people and workers retiring in the future.

In contrast to this, the wage-indexing method provides a sharp tilt in favor of workers retiring in the future. The increases in benefits for workers already retired are limited to increases in the rise in the Consumer Price Index. Yet workers who retire five years later will receive increments due to both price changes and increases in real wages. This difference in retirement benefits can be substantial. For example, consider three workers whose life-time earnings are in the same relative position, i.e., at the median for the total economy. Assume, one man was born in 1911 and retired in 1976, the second was born five years later, 1916, and retires in 1981; the third was born in 1926 and retires in 1991 under the assumptions stated in Chapter 3 of this report, the wage-indexing method would produce the following benefits if they are expressed in 1976 dollars.

MONTHLY RETIREMENT BENEFIT EXCLUDING SPOUSE BENEFITS FOR THREE MEDIAN EARNERS

		President Ford's proposal wage-indexing method		Panel's recommendation price-indexing method	
Year of birth	Year of retirement	Benefit amount in constant 1976 dollars	Ratio of initial benefit awards to 1976 retiree's benefit	Benefit amount in constant 1976 dollars	Ratio of initial benefit awards to 1976 retiree's benefit
1911	1976	$347	1.00	$341	1.00
1916	1981	413	1.19	366	1.07
1926	1991	521	1.50	414	1.21

Measured in constant purchasing power, the man retiring in 1981 will receive 19 percent more in purchasing power (real monthly retirement benefits) than the man who retired in 1976. The man who retires in 1991 will receive 50 percent more in purchasing power than the first person.

The Panel's belief is that each of the features outlined here, the price-indexing approach proves itself more suitable than the wage-indexing approach.

Chapter 2.—Introduction

A specific task given the Panel was to examine the financing and benefit consequences of alternative benefit formulas. Such formulas include those built on the real wage and the relative wage approaches, as well as those related to earnings of a brief period such as the highest five years in the benefit computation period. For each of these, evaluation was to be made of (1) the levels of initial benefits payable to various categories of current and future beneficiaries, (2) the changing patterns of these benefits over many years, (3) cost impacts, and (4) the funding patterns and required financing. Because of time limitations, the Panel concentrated its study on the structure of retirement benefits. Our analysis covered the financing of survivor and disability benefits, but did not examine their benefit structures. We understand that other outside consultants have been engaged to investigate the disability program, and we recognize the need to consider appropriate changes in survivor benefit structures

THE NATURE OF THE MAJOR ISSUES

1. *Benefit formula*.—The present social security benefit formula, legislated in 1972, adjusts benefits automatically to reflect changes in the Consumer Price Index. In addition, the automatic provisions cause the taxable earnings base to rise as average wages under covered employment increase. Both of these indexing provisions were introduced to provide a more orderly and timely means of adjusting benefit levels in response to inflation. But while automatic mechanisms for this purpose are commendable, it is essential that they operate rationally and predictably.

One, but not the only, measure of a formula's rationality is the so-called "replacement ratio". This is simply the ratio of benefits awarded at retirement to workers' taxed earnings before retirement. The general levels of these ratios—how they vary for workers whose earnings histories differ or who retire at different times, and how they vary under different economic conditions—are among the important indicators of how well the program is achieving its intended purpose.

As reported by both the Panel on Social Security Financing and the 1974 Advisory Council on Social Security, the present benefit formula is hypersensitive to changes in the price level. The current automatic provisions act to increase replacement ratios when certain relationships between wage and price increases occur, and to decrease them under other relationships. Large changes in replacement ratio can arise from quite conceivable differences in these relationships. Of course, large changes in the replacement ratio imply large changes in the taxes needed to finance the program.

The operations of the present formula lead easily to situations in which replacement ratios for many workers approach and even exceed 100 percent. In many of such cases the result is a standard of living that is higher after than just before retirement. The frequency of this anomaly is further increased by the existence of the spouse's benefit.

2. *Serious financial deficits over the short-range and long-range of the program.*—The current excess of outgo over income, threatening exhaustion of the OASDI Trust Funds, is largely due to adverse economic conditions of recent years, i.e., the high rates of inflation and of unemployment. The automatic provisions operate to increase benefits according to the Consumer Price Index. On the other hand, revenue for the program is directly related to the total employment rate and to wage levels in the economy. Latest estimates warn that, if no corrective action is taken to prevent it, the Trust Fund will be exhausted by the early 1980's.

The expected long-range financing difficulty of the OASDI program is attributable to both (a) an anticipated increasing ratio of the OASDI beneficiaries to working contributors, and (b) the nature of the benefit formula. It appears that each of these factors may account for about half the problem's magnitude.

3. *Changes in other income maintenance programs.*—The original intent of the social security cash benefit program was that widespread economic dependency be prevented, rather than alleviated once it had occurred. Congress has repeatedly reaffirmed this principle. Prevention was to be based on a three-tiered income maintenance system for those reaching retirement age.

The first tier, established in 1935 and changed extensively in 1972, has been a system of federally matching grants for state old-age assistance programs. Payments are based on need and are subject to a means-test. The assistance program aims to provide subsistence income to recipients. The second tier is the OASDI program which relates benefits to a worker's earnings and, partially, to the amount he or she contributed to the system. Benefit payments, based on earned "rights" rather than on need, are envisaged as providing a "floor of protection" that would supply income adequate for needs for people above the subsistence level. The third tier is the income created through personal savings and non-OASDI pensions.

A problem with the assistance (first-tier) program has been that eligibility requirements and payments have been far from uniform among States. In some cases, the assistance payments have been far below those required for minimum subsistence. Making up the shortage became more and more a *de facto* responsibility of the second-tier social insurance program. As a consequence the OASDI program established a minimum benefit which has been raised substantially to a current level at $101.40 per month.

In 1972, Congress enacted legislation that enables the first tier to provide uniform and adequate subsistence income. The newly created Supplemental Security Income Program (SSI) provides a flat means-tested benefit established by the Federal Government. States whose old-age assistance benefits are greater than those under the new scheme are obligated to maintain benefits at their own higher level. Other States can supplement the basic amount voluntarily. The current (February, 1976) SSI amounts of $157.70 for a single person and $236.60 for a couple approximate what are needed to meet Federal poverty standards; in the numerous cases of State supplementation they bring payments close to or even above recognized poverty standards. The resulting return in responsibility for basic subsistence from the second to the first tier permits drastic reduction, even elimination, of the role that the social insurance system has played in this area.

Of comparable impact upon the third (non-governmental) tier has been the recent passage of ERISA legislation. This law has set minimum vesting, portability, and fiduciary standards for private pension plans, and can be counted upon to raise the assurance of financial protection supplied by corporate pension plans. But perhaps the most immediate result of the ERISA legislation has been widespread use of its provision allowing individual retirement accounts (IRA) for those who are not protected by an employer-financed pension plan. Employees may set aside a portion of their earnings in an IRA account, the incentive being that such contributions and the investment earnings thereon are not subject to current Federal income tax.

Developments in these other programs are themselves cause for substantial revisions in the OASDI structure.

4. *Changes in the female labor-participation rate.*—Forty years ago, most nonfarm families depended for income upon the earnings of only one member. In but a few cases were both spouses employed continuously. This social condition gave rise to a benefit structure that took into account, through a spouse's benefit, the greater financial needs of a family with two adults. Because two-worker families were few, equity between one-worker and two-worker families (i.e., the relation

between the individual's total contributions and the total expected benefits) was not of great concern.

But the situation has changed. Many more married women remain employed throughout a major portion of their working lifetimes. Consequently, inequities in the benefit structure are increasingly common. For example, if both husband and wife are employed, and one spouse has average annual earnings of, say, $12,000 while the other one has average earnings of $3,600, and both must pay social security taxes on their earnings, their total retirement benefits will be 150 percent of the benefit calculated on only the first spouse's average earnings of $12,000. Yet if only one spouse is working and earning the $12,000 average amount, that family receives the same retirement benefit. The first family's contributions to the social security system are 30 percent greater than the second family's, but the retirement[1] benefits are identical. A comparable inequity between single workers and workers with families is observable.

PRINCIPLES GOVERNING THE SOCIAL SECURITY PROGRAM

Over the years, Congress has adhered to three fundamental principles to guide its social security decisions. These principles—(1) individual equity balanced with social adequacy, 2) controllability and long-run stability, and (3) economic efficiency—continue to be perceived as necessary to and consistent with the overriding goal of the system: to provide economic security to American workers and their families in the event of lost income due to retirement, disability, or death. This goal was stated in the original report of the President's Committee on Economic Security, and has been widely accepted ever since by Congress and the general public.

These three principles help to explain the nature of the legislative policy decisions through the years. Because they are the criteria by which any new legislation will be judged, they provide a frame of reference for evaluation and comparison of alternative solutions.

1. *Individual equity and social adequacy*.—Equity and adequacy are bound to be competing objectives. Enhancement of one tends to cause diminution in the other.

Individual equity can be identified as the degree to which an individual's benefit rights are reflected by the contributions he or she has made to purchase those rights. A program in which individual equity is the overriding goal—personal insurance, for example—requires that each individual's benefit amount be based on the actuarial value of that individual's contributions. In a program that completely disregards individual equity, benefits can be unrelated to contributions. Such a program might not even require contributions, but instead be financed from general government revenues. This is the case with the SSI program.

Social adequacy is a welfare objective in which an individual's benefit amount is determined, not by his or her contributions, but by (a) appropriate transfer of income from affluent to needy groups, and (b) a minimum standard of living beneath which society decides that no individual should fall. The Social Security Act of 1935 represented a compromise between equity and social adequacy within a system that was designed to build at least a part of the actuarial reserve that would be necessary to fund a comparable privately operated program. But amendments to the Act steadily shifted the emphasis more in the direction of social adequacy by weakening the relationship between benefits and contributions.

Although the benefit formula emphasizes social adequacy, the benefit level, for all workers already retired and for most who will retire during a long future period, is higher than the level that could be paid from the accumulated value of lifetime contributions by and on behalf of the worker. (The exceptions are the benefits for unmarried workers whose earnings have always been close to the

[1] Survivor and disability benefits are not identical, but this offset is frequently overlooked, particularly when these contingencies have not occurred

maximum taxable earnings base (MTEB), and the benefits for two-worker families both of whose earnings are near the maximum) This situation has developed for two reasons. the maturing of the system, and the "pay-as-you-go" method of financing.

Any pension program, public or private, takes forty years or more to reach maturity. At the beginning of the program, it is often decided to extend full benefit rights to those who are close to retirement age, even though their contributions will have been very small. A worker reaching age 60 in the first year of such a program might be granted full benefits after only five years' contributions, while a worker reaching age 20 in the same year might be required to make 45 years of contributions to qualify for the same benefit This condition, to a large extent, describes the OASDI program

This discrepancy rises to its maximum under "pay-as-you-go" financing, a method in which each year's contribution rate is required to be high enough to finance only that year's current benefits At present, the ratio of retired persons to workers is moderate, hence the required contribution rates are moderate But this ratio will increase as demographic changes result in a greater percentage of the population at or above retirement age Consequently, if the present system continues unchanged, the current generation will have made contributions that are less than those required to finance its future benefits

Moreover, whenever there is growth in working population and in wage rates, the taxable wages will also be increasing Increasing taxable wages produce greater income to the system During a period of growth, then, a worker's contributions into a pay-as-you-go system need not be as large as will be required when the growth is no longer occurring

All of these relationships affect the degree of inter-generation equity as well as of equity among members of each generation Complete equity between generations demands that those different generations receive comparable benefit amounts in return for comparable contributions Ultimate equity within a generation exists only if workers' benefits are directly proportional to the amounts of their contributions. No social insurance program can achieve ultimate equity and social adequacy The objective can only be to do justice to both.

2 *Controllability and long-run stability* —Individual participation in the social security program extends over a long period, a worker can easily have made contributions for forty years before he or she is eligible for benefits Thus, public acceptance and confidence in the program depend largely on the existence of long-term stability Fortunately, in this respect, the social security program has so far proved successful. The credit for this goes to careful supervision and wise legislation on the part of Congress and to sound recommendations by the administrators of the system and its many advisors and students

Two important measures have assured the long-run integrity of the program the regular testing of equivalence of taxes and benefits up to a 75-year period horizon, and the inclusion of a margin of safety in the annual cost estimates Many provisions in a social security system that have little effect in the first years after their enactment can have serious impacts in later years. The 75-year projection gives Congress a much needed measure of the fiscal health of the system. Furthermore, cost estimates have, until recently, contained an added measure of conservatism because no allowance was being made for the effects of the growth of faster-rising earnings over more slowly rising benefits. Congress has used the resulting surplus to increase benefits, but only after, not before, such a surplus has emerged.

It cannot be stressed too strongly, however, that it is impossible for even the best of forecasts to give a precise and reliable indication of what will happen. Future events are largely unpredictable, particularly in an era when the pace of change in economic and demographic conditions has accelerated. Social conditions are changing, and these too have serious impacts on social security.

Consequently, any alteration in the social security benefit structure and financing arrangements should leave opportunity for future Congresses to make periodic adjustment in the light of then current economic, demographic and social conditions. This belief is a cornerstone of this Panel's recommendations.

3 *Economic efficiency*—Although social security's main benefit to society is its help to the well-being of its beneficiaries, its magnitude causes it to have other social and economic implications. Important among these are the effects on individual economic incentives—how the benefit structure and financing influence savings behavior, work incentives, and employment opportunities. Recently, savings behavior has been of particular concern. Many believe that if there were no social security program, workers would save a larger portion of their current earnings to provide retirement income. Under a pay-as-you-go system, contributions collected by the program are paid out immediately as benefits, i.e., no sizable fund accumulates. Consequently, the presumed decline in personal savings is not offset by accumulating national trust funds. The net decline tends to produce scarcity of capital, and thus to increase the prevailing interest rate. To the extent this happens, borrowers have to pay more and capital investments by corporations and individuals decrease.

On the other hand, if the social security program encourages voluntary and earlier retirement, this may have a positive effect on savings: people may see a realizable goal in combined social security, private pension and personal savings, and may save more to make that dream come true. Also, the knowledge that benefits are payable only if retirement occurs may lead some to save more so as to be able to retire sooner.

Another question is the impact on work incentives. If, as is sometimes the case for low-income workers, the benefit approaches or even exceeds the amount of a worker's net annual wage before his retirement or disability, then the incentive to stop working and collect the benefits becomes large. Moreover, work incentive is affected after retirement by the provisions of the retirement test. The current requirement that a beneficiary below age 72 whose earnings exceed $2,760 per year must refund 50 cents on every dollar earned in excess of that amount is equivalent to an income tax surcharge at a 50 percent rate which may well discourage elderly persons from augmenting their retirement incomes through full- or part-time jobs.

For younger workers, however, work incentive is affected by the view taken about their contributions to the system. Workers who see the contribution as a tax are likely to make their decisions by measuring the attractiveness of the take-home pay, which may adversely affect work incentive. But those who picture the system as a compulsory savings program in which portions of current income are being set aside for use after retirement may retain a work incentive only mildly influenced by the size of the payroll tax.

SECONDARY CONSIDERATIONS

An important requirement of any program as large as social security is that it be understandable. Contributors and beneficiaries alike must know their rights and obligations under the system. In addition, the advantages of supplementing, through private provision, the basic protection offered by the system must be visible. The tax incentives involved must be clear to see.

Another consideration that arises when the benefit formula is to be changed is what special treatment is appropriate for people close to retirement time. Correction of the technical flaw discussed earlier should not be at the expense of benefit expectations on which those people have made their plans. This calls for a phasing-in provision that introduces the new benefit calculation over a period of several years. Transitional provisions must be simple enough to avoid administrative confusion and well enough designed to minimize benefit costs; sharp changes that depend upon the retirement date selected must be avoided.

METHOD FOR ANALYZING ALTERNATIVE BENEFIT FORMULAS

To provide a comprehensive analysis of alternatives, the Panel surveyed the benefit formulas used in the social insurance systems of other industrialized nations as well as those used in the private pension field. In essence, there are five major types of benefit structures that appeared of sufficient merit to warrant a closer examination. They were:

1. *A flat benefit formula*—the retired worker receives an established amount regardless of need or contributions.

2. *Money purchase plan*—each contribution paid by or on behalf of a worker is used to purchase a deferred annuity. This type of benefit is frequently found in union-negotiated plans for hourly-paid workers.

3. *High-5 plan*—the benefit is a percentage of the worker's average earnings in his highest five years. The percentage would depend on the number of years the worker has contributed to the plan. This type is sometimes used in employer-sponsored pension plans. The formula tends to produce stable replacement ratios (benefits to pre-retirement wages) from year to year.

4. *Wage-indexed formula*—the benefit is based on a long averaging period of each worker's wage history. For benefit determination the earnings of each year are adjusted proportionately to the average wages of all workers in the social insurance system for that year.

5. *Price-indexed formula*—the benefit is based on a long averaging period of each worker's wage history. Those wages, however, are restated in terms of their purchasing power rather than of their value in units of the national currency.

Each benefit formula has its strengths and its weaknesses. For example, if the sole purpose of the social security program were to stabilize replacement ratios, then the "High-5" method might be the preferred choice. But, as we have seen, there is a plurality of objectives, each of which must be weighed. Thus, certain specific criteria were established by this Panel to evaluate the alternative possibilities. These were:

1. *Adequacy*.—Apart from the weighting of the benefit formula in favor of lower-paid workers, there are two contrasting measures of adequacy. One is the purchasing power of the benefits promised to comparable workers retiring in different years. Another is the replacement ratio, i.e., the ratio of retirement benefit to preretirement earnings. The Panel found that an unexpectedly large proportion of workers experience declining wages in the few years just before retirement. In such cases earnings in the years close to retirement may not be appropriate for calculating the replacement ratio. The purpose of a yardstick like the replacement ratio is to approximate the standard of living to which a person has become accustomed and which the retirement benefit will replace. The Panel selected as its measure of the preretirement living standard an average calculated as follows:

> List the earnings subject to social security tax during the last ten years before retirement. Index each of these by the Consumer Price Index. Eliminate the figures for the one year of highest, and two years of lowest indexed earnings.[8] Divide the sum of the remaining values by seven.

2. *Benefits and costs*.—It is a simple task to design an optimal benefit formula if one can ignore its cost. Under the current-cost financing arrangement, future benefits for each generation of workers depend entirely on the willingness of the next generation to pay the required taxes. If workers lose confidence that their benefits will be paid, a breakdown will occur. In examining the various alternatives, the Panel has considered benefits and costs as an integral whole.

3. *Equity*.—Social security is an earnings-related program. Equity is an important consideration. The Panel examined benefit alternatives in light of three

[8] The reason for eliminating the two lowest but only the one highest was that our inspection of earnings patterns of workers above age 55 persuaded us that abnormal earnings occur much more frequently on the low than on the high side.

types of equity: horizontal, vertical, and inter-generational. "Horizontal" equity means that similar situations are treated similarly; "vertical" equity means that different situations[3] are treated differently.

4 *Effects upon workers with varying earnings patterns*—As noted in Appendix A of this report, the Panel has noted wide variations in wage patterns. Surprisingly, few workers enjoy constant steady rise in wages over their working lifetimes. It is unsafe to assume that a benefit formula that works well for persons with steadily rising wages will be appropriate for those whose wage patterns are irregular.

5 *Tendencies to influence worker behavior*—A benefit formula that markedly encourages people to take unusual steps to augment their benefit amounts (e.g., by earning or reporting exceptionally large incomes at certain times) is generally less fair and desirable than a formula devoid of such features.

6 *Insurance elements*—Any security program, as distinct from a savings plan, should, to the extent reasonable, provide benefits upon the occurrence of contingencies (such as cessation or abnormal decline of earnings) that create need that would not otherwise exist.

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[3] That is, at one particular time—not inter-generational.

Chapter 3.—Benefit Structure

This Panel's recommendation for a new formula for calculating retirement benefits is built upon our belief that the objectives discussed in Chapter 2 can be achieved more satisfactorily and more completely through our recommended formula than through the formula in the present law or through other proposals that are being considered. The specific objectives that are relevant to the changes we are recommending are listed here; other objectives that are basic to a continued successful national pension system but that do not bear upon choice of the benefit formula are omitted.

Objective I. Reducing sensitivity of benefits to changes in economic conditions.

Objective II. At least maintaining the purchasing power of benefits within each generation and also for successive generations of retired people.

Objective III. Leaving to Congress *at the time* the final decision on the degree to which benefit levels and supporting taxes should be increased.

Objective IV. Improving the equity and social adequacy of the system.

Objective V. Avoiding inadvertently supplying opportunities to obtain benefits larger than Congress intends.

Objective VI. Making the benefit computation process more readily understandable.

Objective VII. Avoiding duplication of benefits granted by other programs.

Objective VIII. Encouraging continued development of personal savings and private pensions.

This chapter contains, *first*, a description of the benefit formula that this Panel recommends; *second*, our recommendation for orderly transition from the present to the new formula; *third*, explanation of how our proposal promotes the objectives listed above; and, *fourth*, analysis of the pros and cons of "final-average" (and the somewhat similar "High-5", etc.) benefit formula types that have been discussed but which the Panel believes would prove unsatisfactory.

DESCRIPTION OF RECOMMENDED BENEFIT FORMULA

For retirement at age 65 in late 1976 or early 1977:

Average indexed monthly earnings (AIME)	Initial monthly benefit (PIA)
Less than $200	80 percent of AIME.
$200 to $600	$90 plus 35 percent of AIME.
Over $600	$150 plus 25 percent of AIME.

Expressed in a different way, this formula is:

80 percent of the first $200 of AIME, 35 percent of the next $400, 25 percent of the excess over $600. This formula is designed for indexing by the Consumer

Price Index (CPI). As the CPI rises, the dollar amounts ($200 and $600, and $90 and $150) in the formula will rise proportionately, but the percentages (80 percent, 35 percent, and 25 percent) will remain the same.

The recommended computation periods, averaging periods and numbers of dropped-out years remain the same as under present law. Also, the formula for reduction in retirement benefits that begin before age 65 would be unchanged except as recommended in chapter 7.

The general procedure for setting the Maximum Taxable Earnings Base (MTEB) continues as at present except for a single increase to the point, estimated at $18,900 for 1977, needed to embrace the entire earnings of 90 percent of covered workers, and with provision for periodic monitoring to assure that approximately this percentage continues to be within the future MTEB. The following table shows the percentages, corresponding to the 90 percent level we are recommending, of workers whose entire earnings have been within the taxable earnings base, in past years.

ESTIMATED PERCENTAGES OF ALL COVERED WORKERS WHOSE ENTIRE EARNINGS WERE WITHIN THE MAXIMUM TAXABLE EARNINGS BASE[1]

	1940	1945	1950	1955	1960	1965	1970	1973
Millions of workers	35 4	46 4	48 3	65 2	72 5	80 7	93 1	100 2
Percent having entire earnings within MTEB	96 6	86 3	71 1	74 3	71 9	63 9	74 1	79. 7
Percent men only	95 4	78 6	58 9	63 3	60 8	51 0	61 8	68. 7
Percent women only	99. 7	98. 9	94. 6	93. 9	93. 4	87 3	93. 5	96 3

[1] From Tables 39 & 40 Social Security Bulletin Statistical Supplement 1973

This Panel favors a proviso, which we believe and hope will rarely if ever have to be invoked, that in the event that the national wage-level grows more slowly than the price-level for an extended period, benefits will be adjusted upwards in proportion only to wage growth rather than to price growth. This would apply only if Congress decides at the time that such a limitation is necessary in the national interest. Particulars of this provision are set forth in Chapter 7.

ILLUSTRATIONS

The following illustrations are designed to assist in picturing how benefits will grow if this Panel's formula comes into effect. They are shown in figures and also in Chart A that follows.

BENEFIT ILLUSTRATIONS WORKERS WITH (a) MEDIAN, (b) MAXIMUM TAXABLE, EARNINGS

ASSUMPTIONS ARE DESCRIBED AT END OF THIS CHAPTER

Year of birth	1911	1918	1925	1932	1939
Year of retirement	1976	1983	1990	1997	2004
MONTHLY RETIREMENT BENEFIT IN 1976 DOLLARS					
Median earnings					
Men					
Price-indexed formula	341	375	408	450	511
Wage-indexed formula	347	430	499	578	674
Women					
Price-indexed formula	281	293	312	327	357
Wage-indexed formula	268	321	379	431	505
Maximum taxable earnings					
Price-indexed formula	352	399	438	489	563
Wage-indexed formula	361	440	513	596	699
SHORT REPLACEMENT RATIOS (PERCENT)[2]					
Median earnings					
Men					
Price-indexed formula	42	35	32	30	30
Wage-indexed formula	43	40	39	39	40
Women					
Price-indexed formula	52	45	38	35	33
Wage-indexed formula	50	49	46	46	47
Maximum taxable earnings					
Price-indexed formula	30	25	24	23	23
Wage-indexed formula	31	28	28	28	29

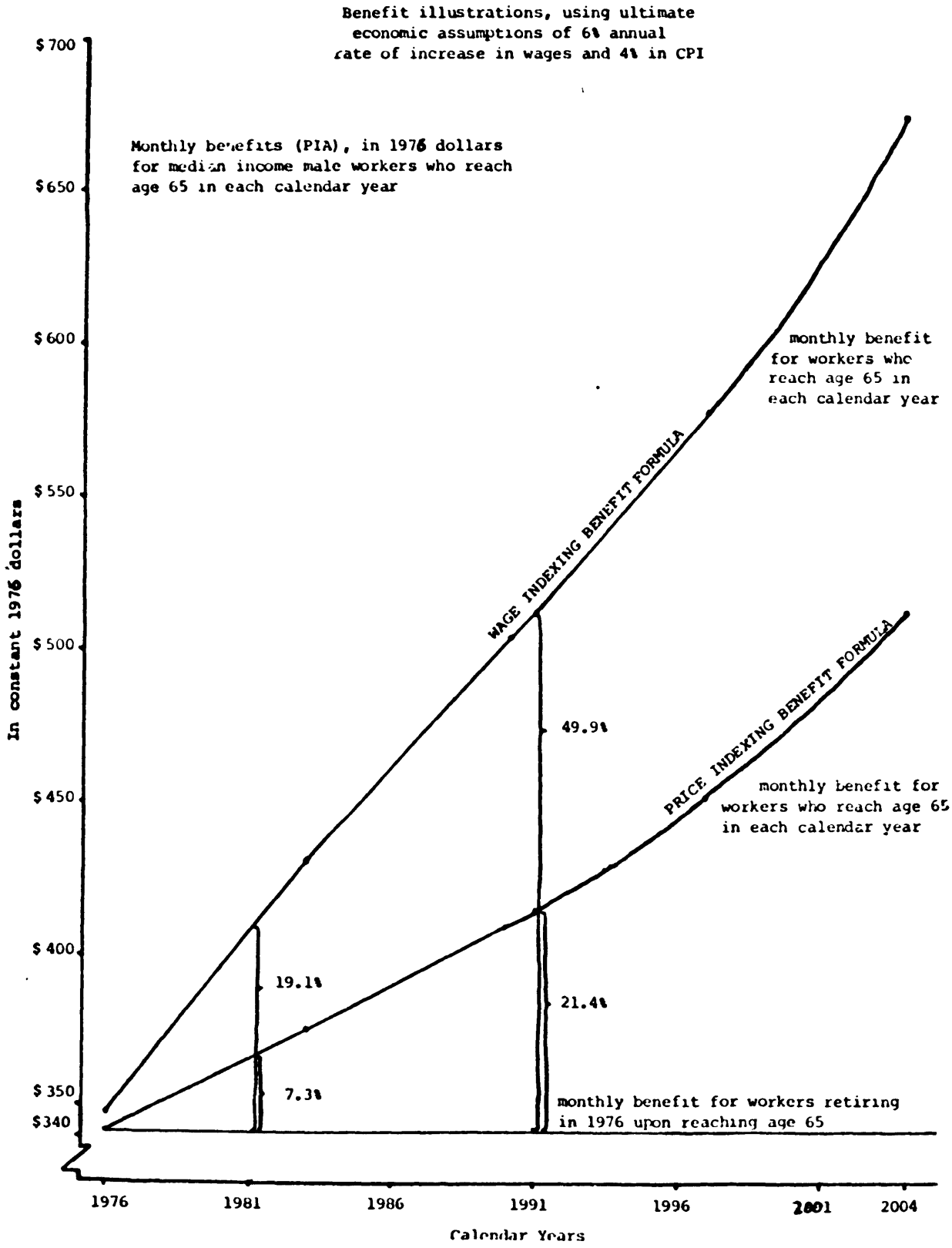
BENEFIT ILLUSTRATIONS—WORKERS WITH (a) MEDIAN, (b) MAXIMUM TAXABLE, EARNINGS—Continued

"LONG" REPLACEMENT RATIOS (PERCENT)[2]

Median earnings					
Men					
Price-indexed formula	38	33	30	29	29
Wage-indexed formula	38	38	37	37	38
Women					
Price-indexed formula	46	44	39	35	34
Wage-indexed formula	44	48	47	47	48
Maximum taxable earnings					
Price-indexed formula	36	29	26	25	25
Wage-indexed formula	36	32	30	31	31

[1] The wage-indexed formula is the same as in chapter 1, table 1

[2] "Replacement Rate" is the ratio of the initial benefit to the worker's covered earnings shortly before retirement. "Short" replacement ratio defines those earnings as the earnings in the final year before retirement. "Long" replacement ratio defines them as the average of price-indexed earnings in the 7 years that remain out of the 10 years before retirement after the earnings of the 1 year of highest earnings and the 2 years of lowest earnings have been stricken


Benefit illustrations, using ultimate economic assumptions of 6% annual rate of increase in wages and 4% in CPI
Monthly benefits (PIA), in 1976 dollars for median income male workers who reach age 65 in each calendar year
$700
$650
$600
$550
$500
$450
$400
$350
$340
In constant 1976 dollars
monthly benefit for workers who reach age 65 in each calendar year
WAGE INDEXING BENEFIT FORMULA
PRICE INDEXING BENEFIT FORMULA
monthly benefit for workers who reach age 65 in each calendar year
49.9%
19.1%
21.4%
7.3%
monthly benefit for workers retiring in 1976 upon reaching age 65
1976
1981
1986
1991
1996
2001
2004
Calendar Years

COMMENTS ON THESE ILLUSTRATIONS

These illustrations are displayed in a manner designed to emphasize two matters that this Panel believes to be of great importance.

The first point is that the effects of any particular formula should be studied in terms of what that formula accomplishes in each of two related but distinct measures, these being (a) the purchasing power of the benefit, and (b) the relationship of retirement benefit to income covered for Social Security just before retirement, i.e., the "replacement ratio".

Discussion of Social Security benefit structure has concentrated heavily upon the second of these as the criterion of reasonableness. But we believe it is just as important to discover whether the proposed formula succeeds in granting nearly equal purchasing power to comparable workers who retire at different times. That is why our table shows the results in terms of constant (1976) dollars as well as in terms of replacement ratios.

Having said this, we must also point out that the definition of "comparable workers who retire at different times" is much more elusive than seems always to be recognized. In our rapidly changing economic and social environment it is a mistake to assume that the future shape of the curve of earnings for even the median worker will be similar to that of the median worker who has already retired. This warning applies with even greater force to earnings of women in view of the changing role of women in the labor market and the widening prohibitions upon discrimination by sex.

The second point is that in studying replacement ratios as criteria of benefit suitability, errors can be made by relying upon a single post-retirement/pre-retirement relationship. Almost no workers in this or any country enjoy a pattern of lifetime earnings that follows the national average pattern particularly when that national average pattern combines, as is customary, wages of people at all ages. It is even true that national median wages portray a pattern that applies to relatively few people. Wage fluctuations are the rule, not the exception.

With this in mind our Panel shows two replacement ratios with the definitions recited at the foot of the table. It is noteworthy that even for the median earnings cases these ratios show markedly different results.

The conclusion that one reaches from these considerations is that any proposed benefit formula must be subjected to a large number of tests involving different earnings patterns, different economic assumptions and different definitions of pre-retirement earnings for replacement ratio calculations.

THE PANEL'S RECOMMENDATIONS FOR TRANSITION

Whenever a change to a new benefit structure is made, special attention must be given to its effect upon people who at the time of the change are close to retirement. This Panel favors what we call a *transition* rather than a different form of arrangement that is sometimes, but rather dubiously, labelled *guarantee*. Our reason for doing this is that we doubt the ability of designers to construct a form of guarantee that, in a period of rapid price change, will be considered as solid a guarantee by the prospective recipient as it may be by the framers thereof.

Our proposal is that no change be made for workers born in 1917 or earlier, regardless of when they retire, and that there be a 5-year transition period during which the benefit to a retiring worker (born after 1917) would be calculated as a blend of the benefits that would emerge under the old and new laws, regardless of which in his or her case is the larger. This blend would be calculated thus:

Year of birth	*Retirement benefit will be*
1917 or earlier	100 percent of the old-law benefit
1918	80 percent of the old-law benefit plus 20 percent of the new-law benefit.
1919	60 percent of the old-law benefit plus 40 percent of the new-law benefit
1920	40 percent of the old-law benefit plus 60 percent of the new-law benefit
1921	20 percent of the old-law benefit plus 80 percent of the new-law benefit
1922 and later	100 percent of the new-law benefit

The Panel recommends that this transitional arrangement be based upon year of birth, not year of retirement. Thus 100 percent of the new-law benefit would apply to workers born in 1922 and later. This transitional arrangement was selected to avoid sizable benefit differences depending on date of retirement. If retirement benefits vary by date of retirement for workers born in the same year, then it will lead to many requests for benefit calculations by the Social Security Administration, and incentives for workers to retire at different dates.

HOW OUR RECOMMENDATION PROMOTES THE EIGHT OBJECTIVES ON THE FIRST PAGE OF THIS CHAPTER

Objective I. Reducing Sensitivity of Benefits to Changes in Economic Conditions

It has been heavily and rightly emphasized that, in the words of one report,[1] the benefit provisions of present laws "may result over the long range in unintended, unpredictable, and undesirable variations in the level of benefits." This Panel endorses indexing of earnings records as the best solution to this problem. For this specific purpose we do not claim that indexing by CPI is superior to indexing by national average wages. Either method accomplishes this objective, and either approach is superior to any alternative that we have studied.

Objective II. Maintaining the Purchasing Power of Social Security Benefits and

Objective III. Restoring Congressional Control over the System

These objectives are different but are best considered here as a unit because this Panel's recommendation for indexing by prices rather than wages relates to both of them and to the relationship between them.

Nobody knows what the future has in store for the relationship between wage levels and price levels, particularly during relatively short periods of possible economic difficulties. The expectation and hope are that this country will enjoy continued growth in real earnings, i.e., more rapid growth in average wages than in average cost of living. Moreover, in the future, as in the past, unpredictable social, demographic, and economic changes will have serious effects on the social security system. For example, discovery of cures for any major diseases would materially alter the benefit disbursements.

The Panel believes the Congress would do best if it were to recognize that a fully automatic system is a less desirable goal than is a partly automatic system that embraces a limited objective and leaves to the future the key decision on how far beyond that limited objective the financial condition of the country and of the system itself will permit. An important implication is that this leaves Congress the flexibility to decides how the increase should be divided among different classes of beneficiaries, reflecting the social needs of the time. We believe also that in accepting a solution geared to:

Moderate Automatic Objective—Plus—Congressional Decision

it is legitimate and proper to keep in mind that most Social Security beneficiaries,

[1] Reports of the Quadrennial Advisory Council on Social Security (1975), p. xv

now and for many, many years into the future, will be receiving retirement benefits whose value is far greater than could have been purchased outside the system by the accumulated combined contributions to the system made from their own earnings *and* by their employers on their behalf.

The Panel believes that whenever Congress exercises its prerogative to increase benefits, a simple change—even as simple as a flat percentage increase for all then present and future beneficiaries—would be fully in keeping with the principles upon which such Congressional decisions should rightly be based. Alternatively, a larger percentage increase could well be granted to groups most in need. A third possibility would be to use a portion of available resources to grant extra benefit increase to all who had retired in past years, on the grounds that they are receiving relatively lower benefits than those retiring currently and in the future. There are numerous other possibilities.

The issue posed by Objectives II and III determines the choice between indexing by prices and by wages. This choice is not easy, but this Panel is recommending the CPI-indexed system for a combination of reasons which include the above and also the following:

1. The very clear need for wider public understanding of how benefits are calculated is an issue favoring CPI-indexing. The public can more readily see why price-indexing is fair and necessary because they are becoming more and more accustomed to CPI adjustments.

2. An argument for wage-indexing sometimes heard—that the national average wage is a fact not subject to doubt or dispute while the CPI is necessarily the result of a calculation that can justifiably be criticized and that does not necessarily reflect the impact of prices on the living standards and buying habits of retired people—seems to us not governing, for at least two reasons.

First, any controversy about applicability of CPI will not in any event be removed by wage-indexing because it is generally agreed that CPI-indexing should continue to be used for adjusting benefits after retirement. Second, even the trend and rate of increase in the national average wage depend, with sharply varying results, upon whether or not age and sex are taken into account.

3. Those who believe that a revised benefit formula should provide for a distribution of replacement ratios that remains unchanged as time passes *will not* find this objective satisfied just by adopting wage-indexing; it would be necessary to freeze the averaging period to come close to accomplishing this.

Furthermore, replacement ratios for workers whose wages exceeded the maximum taxable earnings base—which sometimes has included nearly one-half of all full-time male workers—will increase in the future because of the accelerated rise in the MTEB legislated since the late 1960's. This situation will continue until the turn of the century.

4. The merit of seeking a benefit formula that undertakes to maintain the present distribution of replacement ratios is a source of doubt to this Panel. To throw light upon this question the Panel examined the replacement ratios in a sample of 3,501 persons who applied for retirement benefits in December, 1974. The distribution of these replacement ratios is shown in the following table. The pre-retirement earnings are the gross unindexed covered wages of the year 1973, the last full calendar year before retirement.

NUMBER OF PERSONS CLASSIFIED BY REPLACEMENT RATIOS SAMPLE OF 3,501 RETIREMENTS IN DECEMBER 1974

Preretirement monthly earnings	Total	Replacement ratio (percent)						
		Less than 30	30 to 39.9	40 to 49.9	50 to 59.9	60 to 89.9	90 to 119.9	120 and over
Less than $50	641							641
$50 to $199	268			3	18	62	56	129
$200 to $299	195		12	25	38	90	27	3
$300 to $499	541	21	67	174	167	109	3	
$500 to $699	554	78	162	329	35			
$700 to $849	343	29	266	48				
$850 to $900	959	107	849	3				
Total	3,501	185	1,356	582	258	261	86	773

This analysis shows there is a wide dispersion of replacement ratios under current law. These can hardly be the most desirable ratios in all cases. It hardly seems likely that such a distribution qualifies as the optimal pattern for generations to come.

Objective IV. Improving the Equity and Social Adequacy of the System

There is an inherent weakness in any national pension system that computes benefits by averaging earnings over a period shorter than the full potential coverage period and that also aims to provide relatively larger benefits for low-paid workers. The weakness is that affluent people who are in the system for short periods will be treated just as if they were low-paid workers. It has been observed that in 1969 one-third of social security beneficiaries who were also receiving benefits under another governmental plan were receiving minimum benefits. This is part of the reason why elimination of any set minimum benefit is appropriate.

It is for this reason that the present law provides for gradual lengthening of the averaging period, and that this and other proposals retain this provision. However, the Panel wishes to emphasize that Objective IV can be defeated if the benefit formula were to be of the so-called "High-5" or "High-10" type. Therefore, we are not supporting proposals of this kind that relate benefits heavily to the earnings in a short pre-retirement period. A more detailed analysis of this subject appears at the end of this chapter.

Objective V. Removing Opportunities for Manipulating Benefit Amounts

This Panel shares with others concern about the possibility that a formula will be introduced that will encourage the practice, even though indulged in by just a few, of exercising opportunities to report high earnings in years close to retirement, such earnings having been established for the express purpose of obtaining larger social security benefits. As in Objective IV, such manipulation can be best thwarted by career-averaging rather than by "High-5" and the like.

Objective VI. Increasing Public Understanding of How Benefits Are Computed

This Panel believes that revision of the benefit structure furnishes an opportunity that should be grasped—to simplify the formula as much as can be done with due regard for equity and other considerations. Indexing of earnings records introduces a new complexity that we think is unavoidable; we have kept our recommended formula as straightforward as possible as an offset to existing and new complexities.

Objective VII. Avoiding Duplication with Other Programs

The availability of benefits under the Supplemental Security Income program to needy people permits the adoption of a social security formula that does not contain a minimum benefit. Existence of SSI would not, however, justify failure to recognize in the formula the greater needs of low-paid workers. Our recommended formula, with its 80 percent bracket at the lowest level of average earnings, continues this recognition.

Objective VIII. Maintaining the Three-Tier Concept in Retirement Provisions

Any hazard that the future benefits under social security might more and more preempt the fields of individual savings and private pensions will be avoided when Congress has adopted the proposal offered by this Panel or some similar solution to the problem that the irrationality of the present formula poses.

ANALYSIS OF FINAL-AVERAGING (OR HIGH-5) BENEFIT FORMULA

"Final-averaging" is a type of benefit structure frequently used in private pension plans.[8] Typically the benefit is based on a worker's annual earnings over

[8] And in some plans covering government workers.

his or her last (or highest) five years. For each year of service the benefit earned is a specified percentage of the average of these earnings. Thus, the benefit is related jointly to pre-retirement earnings and years of service.

This benefit type was examined by this Panel to ascertain its suitability for social security. Although it has attractive features, we find this approach contradictory to the goals of the program. We conclude that it is unsuitable for this country's social insurance program.

One of the attractive features of a final-averaging benefit lies in its understandability. Its frequent use in private pensions has made many workers familiar with it. Undoubtedly more people would understand it than could readily grasp the meaning of an indexed formula such as is being recommended.

Another merit is its capacity to stabilize the benefit replacement ratio. If Congressional intent were solely to approach as closely as possible the replacement of a predetermined portion of pre-retirement income, the final-averaging formula would most nearly achieve this. Also it can reduce sensitivity of benefits to changes in economic conditions.

The shortcomings of final-averaging, however, are many. These include: difficulty in weighting benefits in favor of low-income groups; weakening the equity of the system, giving powerful incentives for people to earn or report exceptionally high income in the critical years involved; and, providing inadequate benefits to many because of changes in the value of the dollar interacting with variable wage histories.

A distinctive and necessary feature of a social insurance program is that of granting to low-income workers relatively large benefits in relation to their pre-retirement wages. This cannot readily be done through a final-averaging formula. For instance, it is impractical to vary, by income level, the credits earned from each year of covered employment. One possible solution would be to combine a final-averaging benefit with a uniform flat benefit; however, this would give some retired too little and others too much, and complicate fitting of SSI with OASDI.

Equity is difficult to achieve because the benefit depends only on the years of coverage and the pre-retirement earnings. The relation between the benefit and the lifetime contribution total is diminished.

Experience under municipal plans that use final-averaging has shown its vulnerability to what amounts to manipulation. Employees seek and find ways to raise their wages, e.g., by overtime work, as retirement draws close. Employers are tempted to give their older employees abnormally high wages because of their important effect on retirement benefits. Also, workers not covered under social security, such as Federal and state government employees, can accumulate large benefit credits through part-time covered employment.

It is sometimes held that a final-averaging formula neatly fits the benefit to the family's pre-retirement living standard. The weakness in this argument is found in the extraordinary variability of earnings patterns, particularly among low-income workers. As described in Chapter 6, the Panel has found that in many cases earnings shortly before retirement have declined so sharply that they are not at all representative of career earnings.

The following table shows that in more than 30 percent of cases, male workers have at least one of their highest five years of covered wages occurring more than ten years before retirement.

PERIOD BEFORE RETIREMENT NECESSARY TO INCLUDE ALL THE HIGHEST 5 YR OF CAREER EARNINGS[1]—MALE WORKERS ONLY

	13 Years or more	12 yr	11 yr	10 yr	9 yr	8 yr	7 yr	6 yr	5 yr
Percentage of workers for whom the period of years stated applies	20.9	3.3	4.0	3.5	4.0	5.7	4.6	12.4	41.6

[1] Tabulated from the 0.1 percent CWHS sample of active male workers born in 1907. Workers eligible for minimum benefit excluded. Total earnings for those whose wages exceeded MTEB estimated.

Consequently, if the average of the highest five years of earnings were used to compute benefits, earnings many years before retirement would have to be taken into account in many cases. But money wages earned in such distant years cannot, because of inflation, properly represent the living standards at retirement time. This problem can be solved by indexing but doing so would defeat the simplicity argument favoring the High-5 system.

Supplement to Chapter 3

WAGE-GROWTH, PRICE-GROWTH AND TAXABLE EARNINGS USED IN BENEFIT ILLUSTRATIONS

For the illustrations in this chapter—which are intended to be just the beginning of a series of many illustrations using various earnings patterns and economic assumptions—median total incomes of year-round full-time workers in decennial age groups were taken from Census Bureau Population Reports for every fifth year starting with 1955. (Being medians, these were assumed to represent, with sufficient accuracy, wages only.) Data from SSA records were used to help generate figures for individual ages. The age-by-age relationships of past years, in conjunction with an assumption that the annual wage-growth for 1981/1980 and later years would be 6 percent, were used to produce plausible future values. Figures for sample years are given in the following table.

MEDIAN EARNINGS ASSUMED FOR BENEFIT ILLUSTRATIONS

Birth yr. and sex	Age 30	Age 40	Age 50	Age 60	Age 64
1911					
Men		$3,800	$5,840	$8,610	$9,650
Women		2,360	3,430	5,630	6,450
1918					
Men		5,550	8,940	16,330	18,670
Women		3,190	4,910	9,710	11,230
1925					
Men	$4,350	7,380	14,660	26,580	29,390
Women	2,850	4,070	7,940	15,810	18,640
1932					
Men	5,880	11,750	24,800	39,970	44,190
Women	3,750	6,550	13,410	23,770	28,030
1939					
Men	8,900	20,960	37,280	60,100	66,450
Women	5,430	11,740	20,400	35,740	42,150
Maximum taxable earnings used and assumed.					
1911		3,600	4,800	7,800	14,100
1918		4,200	7,800	20,400	27,600
1925	4,200	4,800	14,100	33,000	41,700
1932	4,800	9,600	27,600	49,500	62,700
1939	7,800	22,200	41,700	74,700	94,500

Note.—Annual price growth for 1983 1982 and later years was taken at 4 percent.

Chapter 4.—Financing

That the OASDI system faces serious financial problems is agreed by the Trustees of the system in their 1974 and 1975 Annual Reports, by the Panel on Social Security Financing, and by the Advisory Council on Social Security. There is also consensus that the forces responsible for the excess of expenditure over payroll tax revenue are associated with recession, inflation, and demography.

Maintenance of a social insurance system depends upon the continued willingness of the citizens to support it. The Congress must select among alternative possibilities for achieving the double goal of fulfilling reasonable benefit expectations and tailoring the program to the tax level acceptable to the current taxpayers.

The financial balance of the system may be altered by taking steps affecting its income or its outgo or both. In this chapter we list several possible actions considered by the Panel that might be candidates for remedial Congressional action.

POSSIBLE ACTIONS AFFECTING INCOME

1. *Use general revenues.*—General revenues are already used to finance the Supplemental Security Income (SSI) Program and other income maintenance programs as well as the Medicaid program. These are examples of many programs supported from the general revenues and designed, at least in part, to improve the well-being of elderly Americans.

2. *Raise payroll tax rates.*—The combined payroll tax rate for OASDI has advanced from 2 percent in 1937–49 to the current level of 9.9 percent. Further increase in the payroll tax rate is the most obvious way to strengthen the financing of the system.

3. *Raise the wage base.*—The maximum taxable amount of annual earnings subject to payroll tax has increased from $3,000 in 1937–50 to $15,300 in 1976, the largest increases in this maximum having been made very recently. Nevertheless, the percentage of workers whose entire earnings are within the taxable maximum is lower now than in the early days of the system.

Historical percentages, taken from table 40, *Social Security Bulletin, Annual Statistical Supplement, 1973*, have been as follows: 1937, 96.9; 1940, 96.6; 1950, 71.1; 1960, 71.9; 1970, 74.1; 1973, 79.7. Additional revenue could be produced by increasing the taxable maximum. This would quickly improve the current financial position. However, since benefits are a function of average wages subject to the payroll tax, any increase in the taxable maximum ultimately creates additional benefits. Nevertheless, because of the nature of the existing benefit system, increasing the taxable maximum has the long-range result of moderately strengthening the financing of the system.

4. *Modify the tax-free status of benefits.*—Many students of taxation believe that the simplicity and equity of the Federal Income Tax may be improved by minimizing the types of income excluded from the tax base. Those holding this view would conclude that exemption of OASDI benefit payments serves to narrow the tax base and contributes to the problems of creating a simple and equitable Federal Income Tax. In addition, this can modify the extent to which the weighting in the benefit formula helps the genuinely needy rather than those reaping windfalls.

One line of reasoning supporting this exception has been that the beneficiary has made contributions to the system with income already taxed. A second justification, especially relevant before the advent of double personal deductions for the elderly and Medicare, was the presumed special need for income by the elderly. Currently, with several income and service programs designed to help

the elderly, it may reasonably be asked whether subjecting all or part of the OASDI benefits to Federal Income Tax would promote equity. Directing the extra revenue so generated into the OASDI Trust Fund would strengthen the financing of the system. The Tax Expenditure Estimates by Function, part of the Budget of the United States, estimates that in fiscal year 1977 approximately $4.4 billion of income taxes would be generated if two-thirds of OASDI benefits were subject to taxation.

5. *Adjust tax rate of self-employed.*—Since 1973 the tax rate on the self-employed has been frozen at 7 percent. Previously it had been set at 75 percent of the combined employer-employee tax rate. If the earlier relationship prevailed, the OASDI tax rate for self-employed would be 7.4 percent. Restoring the historic relationship between the tax rate for employees and for the self-employed would strengthen the financial status of the system.

POSSIBLE ACTIONS AFFECTING OUTGO

1. *Modify the basic benefit formula.*—Correcting the technical flaw in the 1972 amendments would remove the financial impact of over-indexing. Chapter 3 contains the Panel's recommendations on this issue. Their enactment would go far toward restoring financial balance to Social Security without adversely affecting benefits to those already retired.

2. *Raise the retirement age.*—The Report of the Advisory Council (Chapter 7, Sec. 6.3) noted the favorable financial impact of increasing the retirement age to 68 by the year 2023. The unanswered questions are whether the individual and institutional changes needed to employ elderly persons productively would be made, and whether undue hardship for many people would be a consequence.

3. *Strengthen the retirement test.*—The retirement test reduces benefits to those who are only partially retired. Decreasing the limit on earnings before benefits are reduced, or increasing the benefit penalty for covered earnings in excess of the limit, increases the savings to the system. However, the impact of the retirement test on individual decisions to retire and on employment practices for the elderly is far from being understood. For example, it is to be expected that elimination or weakening of the retirement test would encourage more of the elderly to seek employment with a resulting increase in payroll tax income. As a consequence, the net effect of any modification of the retirement test is not obvious. However, removing or weakening the retirement test would have an almost completely predictable impact on the income tax. Removal of a deterrent to earning income can be expected to generate additional Federal income tax.

4. *Remove the opportunities for windfall benefits.*—The OASDI system has always involved a compromise between equitable benefits (those directly related to taxes paid) and adequacy (benefits designed to assure reasonable living standards for all). Any weight given to adequacy must cause some participants to receive benefits not closely related to their payroll tax payments. However, since the system is wage-related, it cannot be the mechanism for solving all income maintenance problems. Nevertheless, the financial status of the system may be improved by identifying and reducing benefits not needed for social adequacy and bearing no reasonable relationship to past payroll tax payments, and by a move to universal coverage.

5. *Modify spouse and dependent benefits.*—Although many complications may alter a benefit paid a particular family, the total benefit to a spouse is frequently one-half the worker's benefit unless the spouse is entitled to a larger worker's benefit. In such cases the replacement ratio for a worker with a spouse is 50 percent higher than for a similar worker without a spouse. The financial status of the OASDI system could be strengthened by a reduction of the spouse benefit.

RECOMMENDATIONS

This Panel's major financing recommendations are as follows:

1. *The OASDI system should continue to be financed by a payroll tax.*—Reliance on the payroll tax helps to make the public aware of the cost of the system. This

awareness encourages thoughtful response to suggestions for revision. Also, the OASDI system provides benefits that are a function of wage histories. Consequently, it seems appropriate that wages be the financing base for the system. It is settled in law (Nestor vs. Flemming) that the right to benefits is not based fundamentally on a history of payroll tax payments. The Congress has the right to change the benefit structure and the financing at any time. However, because many people base their financial plans in part on OASDI, stability is an important requirement of this program. Reliance on the payroll tax contributes to stability of the system, and we recommend its continuation.

If the benefit side is ignored, the payroll tax can be labelled as regressive in that it bears proportionately more heavily on low-income families than on high-income families. However, the real issue in family finance is the *total* federal tax burden carried by low-income families. The problem of taxes paid by low-income families can best be faced comprehensively rather than be considered in isolation in revising the payroll tax supporting Social Security.

For computation of the Federal Income Tax on 1975 income, the Congress has approved an Earned Income Credit. The effect of this credit is to reduce the burden of Federal Income Tax, and even to provide direct cash payments to a group of low-income taxpayers. The taxpayers currently covered are those with both earned and adjusted gross income below $8,000 who have dependent children. The relevance of this to the OASDI system is that the burden of total Federal taxes on some low-income families has been reduced directly. Modification of the Earned Income Credit provides means for directly affecting the Federal tax burden of low-paid workers. This method seems both more comprehensive and administratively simpler than an alteration directed to the same goal in the payroll tax structure supporting OASDI.

Several income and service programs that operate at least in part for the low-income elderly (SSI and Medicaid) are already financed from general government revenues. This Panel (see Chapter 3) is recommending elimination of a minimum benefit from the wage-related OASDI system. This recommendation will probably require in due course increased benefits paid through the needs-related SSI program, which seems a natural division of both the responsibility for benefits and the associated financing.

When one extends this review beyond programs that provide income and direct services to the elderly, one observes a host of social service programs and indirect subsidy programs for institutions serving the elderly that are funded from the general revenues. The Panel approves the use of general revenues in such programs but not for bolstering the wage-related long-term social security cash benefit system.

The principal device for increasing the income of the OASDI system should be to increase the revenue from the payroll tax. Once the decision not to rely on general revenue financing for a significant portion of the benefit cost for the wage-related OASDI system has been made, one is forced to turn to increased tax rates as part of the means for obtaining the income needed to provide benefits.

2. *In accordance with this view, the Panel recommends that an increase in the payroll tax of 0.3 percent (0.15 percent each for employers and employees) and an increase in the maximum taxable earnings be enacted.*—These actions affecting income will take care of the short-run financial problem faced by the system[1] and will produce a balanced income and outgo *provided* (a) the nation's productivity, i.e., the margin of wage increase over CPI increase, can be maintained at two percentage points, (b) the fertility rate returns to a population replacement level before the end of this century, and (c) other less potent elements of the assumptions used in the 1975 Trustees Report prove to be realized. In Chapter 1 the Panel has emphasized the sensitivity of costs to the trends of economic and demographic influences.

[1]The Panel reminds readers that we have not explored what may be needed to take care of expected additional costs of the disability benefits of OASDI.

As mentioned in Chapter 3, this Panel's emphasis is upon legislating a benefit structure that can be financed by a relatively level prospective tax rate, not a significantly increasing tax rate. Congress can decide to increase benefits and taxes at any time (including now).

The Panel believes that an annual maximum on earnings for the double purpose of payroll taxes and defining benefits should be retained. The Advisory Council (Chapter 7, Sec. 6.2) considered increasing the maximum covered wage to $24,000 in 1976 as a means for strengthening the financing of the system. This action was not recommended because it reduced the long-term deficit by a relatively small amount and because a higher maximum might interfere with private savings and pension programs that are planned to coordinate with social security.

This Panel considered the possibility of removing the maximum on the earnings that are subject to the employer's tax. This proposal would strengthen the financing of the system by increasing income without a resulting increase in benefits. We do not recommend this for the following reasons:

(a) Abandoning the limit on earnings subject to employer's share of the payroll tax would give undue advantage to self-employed even if the Panel's recommendation for their tax were to be adopted. (b) Differing limits on wages subject to employer, employee, and self-employed taxes might be self-defeating by generating altered relationships among workers and employers. (c) Removing the maximum on earnings subject to the employer's tax will not solve even the short-term financing problem.

The Advisory Council (Chapter 7, Sec. 6.2) points out the arbitrary nature of the current maximum ($14,100 in 1975, $15,300 in 1976).

3. *The Panel recommends that the taxable maximum be increased to the point at which approximately 90 percent of workers have their entire wages covered.*—This would mean that in 1977 the taxable maximum would be $18,900.

The maximum will continue to move with average wages as under current law. However, there is no assurance that the percentage of workers whose wages are totally taxed will remain constant. Because of technical statistical problems in estimating these percentages, it is not recommended that the taxable maximum be indexed by statute to this measure. Consequently, Congress should continue to monitor these percentages, which are regularly reported by the Social Security Administration. The objective would be to assure that a shift in wage distributions or some unexpected consequence of the automatic adjustment in the MTEB has not significantly altered the extent of coverage of the system.

4. *This Panel recommends that the self-employed tax rate be restored to and maintained at 75 percent of the combined rate for employers and employees.*—Chapter 7 analyzes in detail the reasons for this recommendation.

Chapter 3 of this report discusses one of the fundamental recommendations by this Panel, that price-indexed wage histories be used in the benefit formula. In this chapter, devoted to financing, one aspect of this reasoning needs to be emphasized. This is that although a benefit formula based on price-indexed wage histories tends to produce declining replacement ratios if real wages grow, the decline is far from being uniform. There will also be a decrease in the dispersion of these ratios. But real wage growth creates margins that Congress can use to the extent considered needed from time to time to alter the distribution of replacement ratios.

In the absence of real wage growth, replacement ratios will tend to increase, with resulting financial strains on OASDI. But in such a situation many even more serious institutional readjustments will be needed, and the Panel's recommended benefit structure can be suitably altered.

Another subject affecting financing is the selected retirement age. Until we can more clearly understand the consequences of retirement choices, the normal retirement age should, in the Panel's opinion, remain at age 65. The Advisory Council (XVII, Recommendation 3) suggested that serious consideration be given to raising the retirement age early in the next century as a method of

managing the long-term financial problem. In Chapter 7, Sec. 6.3 of the Advisory Council Report it is indicated that significant reductions in the tax rate required in the years 2025-2050 could be achieved by raising the retirement age to 68 by the year 2023.

It is important to recognize the arbitrariness of age 65 as the normal retirement age, and also to recognize that early retirement from the work force is often not what elderly Americans desire. Several questions must be faced before recommending raising the normal retirement age. First, studies have shown that elections to retire early are motivated often by poor health and availability of funds (as well, doubtless, as by difficulty in obtaining and keeping jobs) rather than by desire for leisure.

Whatever the reason, in 1974, 48 percent of insured workers aged 62–64 were receiving benefits, the highest level yet reached. In 1973, 61 percent of total retirement benefit awards went to workers aged 62–64. This compares with 54 percent in 1963.[3]

In summary, although the reasons for retirement before age 65 are not clearly known, a great many workers do retire before age 65. To meet the long-term financial problem by increasing the retirement age to 68 may only shift the burden of the demographic change to workers aged 62 to 67 through the medium of reduced benefits. In the absence of knowledge of what motivates workers to retire when they have the option to do so, and of the social needs and opportunities that permit employing those aged 62 to 67 in the work force, we are not recommending increasing the retirement age.

The social experiment outlined in Chapter 7 is proposed to help answer these questions. It is entirely possible that with acceptable changes in employment practices our economy can employ many more of the elderly. It may be that financial incentives to work beyond age 65 will succeed to an extent that the financial balance of the OASDI system may be improved without reducing benefits to those who do retire. If so, these changes should be introduced to encourage the elderly to participate fully in American life, as well as to reduce the financial burden of OASDI.

A retirement test should in our view be retained, its ultimate form to be determined from the results of the recommended social experiment. As long as replacing income lost as a result of retirement, death, or disability is a defined goal of the system, some method for specifically identifying income loss must exist. A major liberalization or elimination of the test is inconsistent with the historical, and in our view appropriate, goals of the system. Elimination of the retirement test would, by current standards, produce "windfall" benefits and add to the system's fiscal difficulties. This Panel endorses the Advisory Council's recommendation that except for the first year of entitlement, the retirement test be based on annual rather than monthly earnings.

FUNDING PATTERNS ARISING FROM THIS PANEL'S RECOMMENDATIONS.

The OASDI system is now financed on a current cost basis. Because of the maturation of the system, the tax rate needed to support the OASDI system has increased at irregular intervals over the history of the system. If the population of the United States were stationary (births equal to deaths and the age distribution stable), one would expect that after forty years required tax rates would stabilize. However, the age distribution of the United States population is far from stable despite the fact that the current fertility rate has fallen below replacement level. Instead, the growth of population in the working ages has made the tax burden of current-cost financing relatively light during most of the history of OASDI. Starting about the year 2010 the demographic situation will enter a dramatically different phase, the elderly population growing much more rapidly than the working population. This will place a strain on current-cost financing.

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[3] Tables 52 and 55, *Social Security Bulletin, Annual Statistical Supplement, 1973*

Some of the financing options applicable to the present benefit structure have already been discussed. (1) Benefits could be reduced by raising normal retirement age to age 68 or higher. (2) Tax rates could follow directly current cost reaching perhaps even 25 percent of taxable payroll in 2040. (3) General revenue financing could be resorted to under the theory that the demographic burden may be temporary and will be associated with reduced demand for government services to the young; but supporters of that method should realize that the number of elderly people is reasonably predictable while the number of young is not, and government services for the young are largely a responsibility of state and local rather than Federal authorities. (4) A limited program of advance funding could be started well before fiscal problems are upon us.

Under the benefit structure that this Panel is recommending, a level payroll tax rate shows prospect of generating some advance funding. On the other hand, if the Congress elects to use some of the expected margins to increase benefits, then a series of small increases in the payroll tax might be appropriate with a view to reducing the extremely high tax rates that would be required in the second quarter of the next century.

For such a program of partial funding to succeed in reducing the burden of an unusually high portion of elderly citizens, several conditions would have to be met. First, the temptation to increase benefits during the twenty years when a partial fund would be built up would have to be resisted. Second, if government expenditures remain unaffected by the extra support available from investing OASDI Trust Fund in government securities, the impact would be reduced government demands for funds from the capital markets, perhaps leading to declining interest rates, increased private investment and prosperity which could lighten the burden of the demographic-induced OASDI crisis.

It is premature to recommend the enactment of specific tax rates to accomplish such a program. However, the Congress should be aware of the alternatives to financing the bulge in OASDI benefit payments caused by the country's changing age distribution.

The Panel believes that the payroll tax is not the proper instrument to encourage capital formation in the United States. Nor do we recommend a basic change in the current cost approach to financing. However, the changing age distribution in the United States will require major adaptations by all institutions in our society. The options available in making the required changes should be carefully explored. Painful as some of these choices may be, the citizens of the United States should recognize that unlimited population growth would pose even greater economic and social problems.

Chapter 5.—Family Benefits

After developing its recommendations for changes in the basic benefit structure, the Panel turned its attention to several important needs for change in the structure of family benefits. We have not examined these matters in sufficient depth to justify describing our conclusions as recommendations, but we are offering several proposals that we believe to be worthy of consideration. In this chapter several such proposals are presented under the following headings:

1. Spouse Benefits After Retirement.
2. Child and Mother Benefits.
3. Pre-Retirement Survivor and Disability Benefits
4. Family Maximum Benefits.
5. Divorced Wife and Widow Benefits.
6. Additional Detail on Spouse Benefits.

1. Spouse Benefits After Retirement

The retired spouse of a retired worker now is granted a benefit equal to the larger of the benefit based on the spouse's own earnings record or one-half the benefit based on the worker's record (subject to reduction below age 65 and to the family maximum). Whatever the virtues of this treatment in the past, the pronounced trend toward two-worker families and the increased frequency of divorce warrant serious reconsideration of family benefits.[1] Current law does not produce a satisfactory pattern of replacement ratios for two-person families relative to one-person families and, as we have illustrated in Chapter 2, unfairly gives different benefits to two-worker families that have identical total earnings but divided differently between husband and wife.

In this section our proposal will be stated for the simplest case—that of a retired couple at age 65. Complications arising from age and retirement date differences, early retirements, and divorces will be treated in Section 6.

This Panel believes that in general the family, not the two separate individuals, should be the criterion for equity in social security. The current law seriously violates this equity principle as is indicated in the following table showing benefits arising from the same earnings shared differently. The benefit formula recommended in Chapter 3 does not in itself remedy this inequity.

This calculation ignores the temporary existing difference in averaging periods for men's and women's benefit calculations.

FAMILY BENEFITS FOR A TWO-PERSON FAMILY

[With different shares of income earned by husband and wife Retirement in 1976. Both Spouses aged 65]

	Division of earnings (percent)	Monthly benefit under current law
Low Earner (AME = $183)	50-50	$239 40
	75-25	257 90
	100- 0	264 80
Middle Earner (AME = $439)	50-50	388 00
	75-25	388. 20
	100- 0	445. 10
High Earner (AME = $585)	50 50	458 40
	75-25	455 60
	100- 0	546. 00

[1] In 1940, 14 percent of married women with husbands present were in the labor force; by 1950, this became 22 percent; by 1960, 31 percent; by 1970, 40 percent. In March, 1974, in 51 percent of the 36.4 million husband-wife families in which the husband was between ages 25 and 65, both worked in the paid labor force. [Sources: D. Cymrot & L. Mallan, "Wife's Earnings as a Source of Family Income," U.S. Department of Health, Education and Welfare, Social Security Administration, Office of Research and Statistics, Note N 10, April 30, 1974, p. 14, and *Current Population Reports*, Series P-60, N 97, January 1975, p. 155.]

As the table indicates, the one-worker family gets the largest benefit, while benefits for two-worker families depend somewhat upon the share of income earned by each spouse. Such differences seem inequitable since these families have had approximately the same earnings histories. There follow the Panel's recommendations for remedying this.

PROPOSAL NO. 1A: That upon retirement of both husband and wife, even if only one of them has insured status, they may choose between (1) averaging their two AIME's and receiving a family benefit equal to double the benefit based on the average AIME, or (2) a benefit to each spouse based on his or her own earnings record. The benefit under (1) would be divided between the spouses in proportion to the PIA's of their respective earnings records, subject to a minimum of one-third and a maximum of two-thirds. Throughout life a person would be permitted to average AIME's with only one other person. The present spouse benefit would be eliminated, and the child's and mother's or father's benefit would be revised.[8]

PROPOSAL NO. 1B: That in the event of adoption of Proposal No. 1A consideration be given to suitable revision of the factors in the basic benefit formula recommended by this Panel in Chapter 3 so that the annual disbursement will be approximately the same as would result from combining the present recommendation of Chapter 3 with the spouse benefit under present law.

ANALYSIS OF PROPOSALS NO. 1A AND NO. 1B: The Panel regards this change as desirable on either of two counts: as a solution to the problem of differing treatment of families of different sizes, or as a temporary expedient during the necessarily slow building of individual wage records for all potential beneficiaries proposed in Chapter 7. There are basically two approaches that will accomplish the objective of making family benefits identical whatever the division of earnings between spouses. One is our proposal—averaging earnings records *after* both spouses have retired, a method that closely parallels income tax provisions for income splitting between husband and wife. The alternative—averaging earnings records each year and granting benefits based on these two separate records—fails, for reasons stated in Chapter 7, to give suitable benefits when the spouses retire at different times. Even if it were satisfactory for the future, it involves serious transition problems not found in our proposal. It works poorly or may even be impractical for recognizing past earnings in the many divorce and remarriage situations that exist.

The following natural questions about the characteristics and implications of our Proposal No. 1 arise and are answered as stated.

Question 1. How do benefits to a couple depend upon the proportions in which their combined AIME is divided between them?

Answer. Our proposal makes the benefits completely independent of the share earned by each in the total of their AIME's.

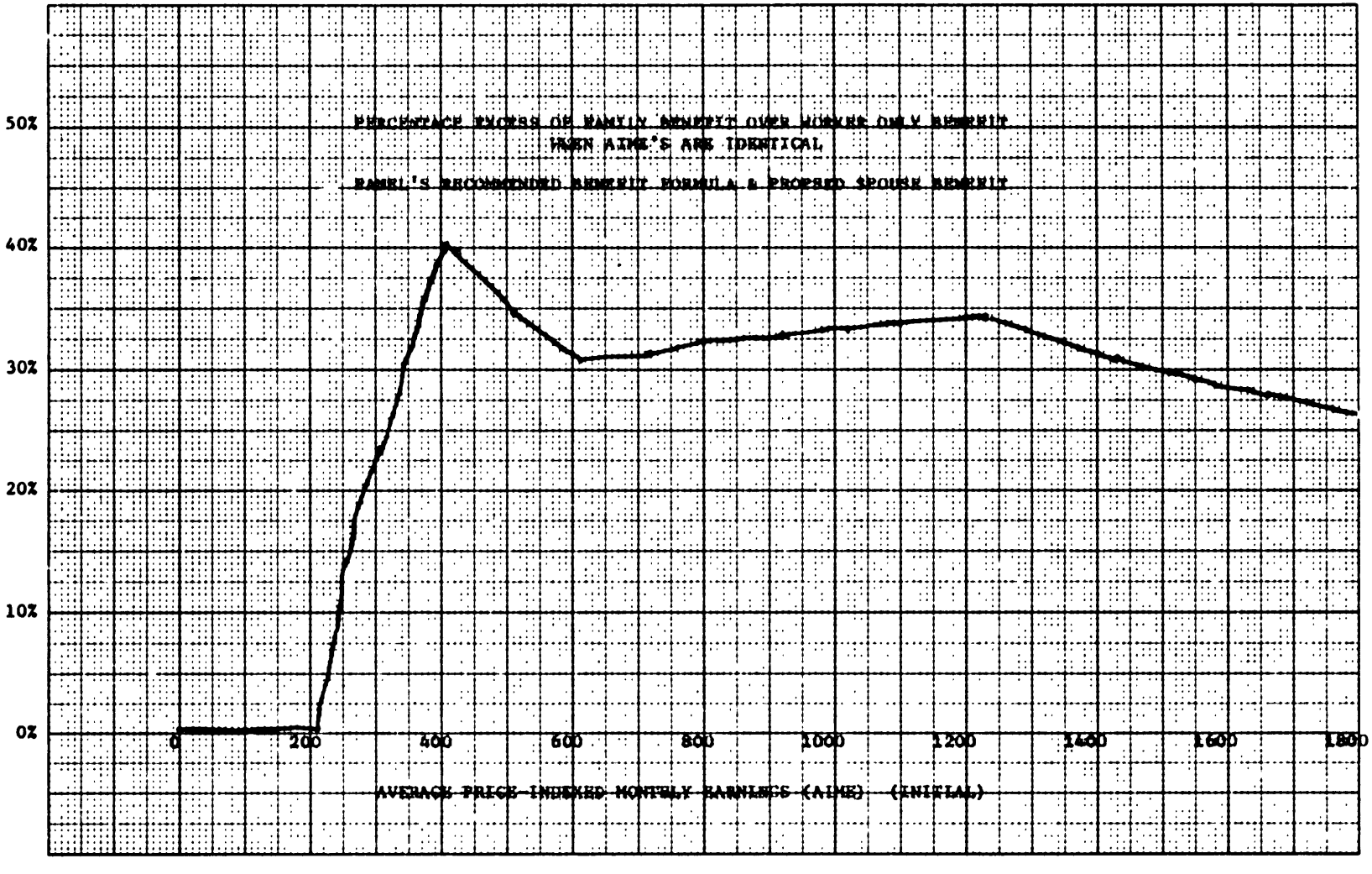
Question 2. How do benefits to a couple with a specified total AIME compare with the benefits the couple would have received if the present spouse benefit had been retained in conjunction with our price-indexing recommendation?

Answer. This depends upon whether only Proposal No. 1A is adopted, or whether Proposal No. 1B is adopted also.

If only No. 1A is adopted, it can easily be shown that the spouse benefit in a one-worker family will never be as high as the 50 percent under present law. It is also true that the circumstances under which no spouse benefit at all will accrue are different under our proposal and present law.

In the situation in which the entire AIME is earned by one spouse, the effective spouse benefit is at its maximum, 39.1 percent, when the AIME is (currently) $400. Below $400 it declines until it is zero at AIME's of $200 or less.

[8] The reason why we have chosen to average the AIME's rather than the earnings records themselves is that the former seems fairer in dealing with spouses of different ages and different periods in covered employment. Admittedly, it is less satisfactory to have dropout years reflect individual rather than family earnings histories but we consider this less important than the other point.


PERCENTAGE EXCESS OF FAMILY BENEFIT OVER WORKER ONLY BENEFIT
WHEN AIME'S ARE IDENTICAL
RAMEL'S RECOMMENDED BENEFIT FORMULA & PROPOSED SPOUSE BENEFIT
50%
40%
30%
20%
10%
0%
0
200
400
600
800
1000
1200
1400
1600
1800
AVERAGE PRICE INDEXED MONTHLY EARNINGS (AIME) (INITIAL)

Above $1,200 it also declines steadily. Between $400 and $1,200 there is first a sharp decline, but then, between $600 and $1,200 a rising tendency. This pattern can easily be converted to a steady decline by moderately changing the percentage factors in the benefit formula recommended in Chapter 3. For example, if these factors were 90 percent, 36 percent, and 27 percent instead of 80 percent, 35 percent, and 25 percent, the curve beyond $400 would contain no increases. The pattern discussed here is shown in the chart on the preceding page.

In appraising the rationality of the pattern shown by this chart, certain matters should be recognized. First, when the AIME is low, the replacement ratio is already high without any spouse benefit. Second, when a couple is poor (e.g., has only social security benefits), the couple is eligible for SSI payments, presently $236.60 a month. A worker who has always earned the legal minimum wage through a full career in covered employment must now have an AIME of $353, which the chart shows corresponds to close to the maximum percentage spouse benefit under our proposal. Cases in which the AIME is substantially less than this and in which the SSI benefit is not payable must be cases of short periods of covered employment.

Furthermore, many two-worker families who would receive no additional benefit under present law will receive a spouse benefit under our proposal. If the spouse with the lower AIME has a PIA equal to one-half or more of the higher earner's PIA, a spouse benefit will usually emerge under our proposal as illustrated in the following table, but present law provides no spouse benefit.

FAMILY BENEFIT FOR TWO-WORKER FAMILY WHEN PIA OF LOWER EARNER IS ONE-HALF PIA OF HIGHER EARNER

AIME		Family benefit	
Higher earner	Lower earner	Current spouse benefits	Panel proposal
$200	$100	$240	$240
300	122	293	328
400	144	345	370
600	188	450	456
800	243	525	545
1,000	314	600	629

All of these figures and relationships would be altered if our Proposal No. 1B for modifying the factors in the basic benefit formula so as to disburse the amounts that otherwise might be saved due to the generally lower spouse benefit were adopted. Since we have no cost estimate for this proposal, we cannot make a specific statement of the factor changes that would bring the whole benefit structure to a break-even point.

Question 3. How do benefits for a couple compare with benefits for a single worker?

Answer. The figure above shows the amount received by a couple in excess of the amount going to a single worker with the same AIME. A couple with a given AIME has had less income per person than a single worker with the same AIME. Thus it seems appropriate that the couple receive a larger benefit for the same AIME. If the costs of living were twice as high for a couple as for a single person, it would seem right to treat a couple as if they were two persons, each with one-half of the couple's income as is done by our proposal. Since two can live for less than twice what it costs for one, our proposal is still generous to couples.

To complete our suggestions for spouse benefits, it is necessary to offer supplementary proposals for survivor benefits when one of the spouses dies.

PROPOSAL No. 1C: That upon death of a spouse after a family benefit determined by averaging of AIME's has been awarded, the surviving spouse will receive 4/3rds of the PIA based on the averaged AIME (i.e., 2/3rds of the family benefit).

PROPOSAL No. 1D: That upon death of a worker aged 62 or older before averaging of AIME's has been taken, the surviving spouse may choose between (a) a benefit determined by averaging the survivor's and the deceased spouse's AIME's, or (b) a benefit based on his or her own earnings record.

The basic justification for giving the survivor two-thirds of the family benefit is recognition that expenses of one are usually greater than one-half those of two. The two-thirds rule may seem too generous if the spouse is considerably younger than the deceased and will not begin receiving benefits (at age 62) until long after the death of the worker. Perhaps it would be best to scale this proposition gradually downward so that it would be as low as one-half for much younger spouses.

Under these proposals no widow or widower benefit would be available on the record of the deceased worker, except that an adjustment must be made for widows or widowers under age 62. Under current law a widow or widower receives no additional benefit from her or his own covered earnings if the AIME of the deceased worker is larger than that of the survivor. Our proposal is more generous to all surviving lower earners. On the other hand, death of the lower earner will leave some survivors with lower incomes as a consequence of having averaged their lifetime income for benefit calculation.

2. Child and Mother Benefits

Under current law, a dependent unmarried child can receive benefits upon retirement of one of his parents,[3] provided the child is under 18, between 18 and 22 and attending school, or under disability which began before age 18. The benefit is one-half the PIA of the parent (subject to the family maximum). A child can collect benefits based on only a single earnings record. In addition, a woman, of any age, can receive benefits based on her retired husband's earnings record if she has in her care a child under age 18 who is entitled to benefits on her husband's record. The benefit is one-half the PIA of the husband (subject to the family maximum).

These benefits are not entirely in keeping with changing social patterns and the view of Social Security which has been taken by this Panel. After both parents have retired, it seems inappropriate to have a child's benefits depend on the division of family earnings between the parents; it seems better to permit a child to receive benefits based on the earnings records of both parents. A similar argument holds for survivor benefits. Also, we doubt that a family's replacement needs are increased 50 percent by the presence of a child. Benefits for a child should reflect the extent to which the child increases the family's necessary expenditures. Sharing expenditures on non-necessities with children does not, in our view, justify an increased replacement ratio.

A simple way to incorporate these considerations into the benefit structure is to impose a maximum on the benefit for the child of a retired worker. (Different considerations hold for children of deceased workers.) We believe that the first bend-point ($160 on a $200 AIME initially) in the formula recommended in Chapter 3 stands as a reasonable measure of necessity level.

PROPOSAL NO. 2A: That the benefit for each dependent child of a retired worker not exceed one-half the PIA based on the AIME at the first bend-point of the benefit formula. A child may receive benefits based on two earnings records (or double that arising from averaging) if both parents have retired, but subject to a single maximum, initially $80 per month.

This proposed maximum is approximately the same as that received by a spouse under SSI. This limitation is of course not appropriate after the death of a retired worker. To incorporate our proposal into the general structure of children's benefits, it is necessary also to define benefits at the death of a worker who has averaged.

PROPOSAL NO. 2B: That at the death of a retired worker whose earnings record has been averaged, the maximum limit on a child's benefit be removed. However, the increase in benefits for the surviving spouse and all children should not exceed the benefit that the retired worker received before death.

Under current law, if no children are present, the wife of a retired worker is

[3]Or grandparents, if the parents are dead or disabled and the child is living with the grandparents.

not entitled to any benefit until she is 62 years old. The premise is that a younger person can look after herself.

Nevertheless, a young mother with dependent children is entitled to a spouse benefit. This provision fails to recognize the growth of two-worker families and the more equal modern roles in child raising. Since a retired worker presumably is available to look after a child, it seems unnecessary to maintain the young mother benefit for children of school age. Here also it seems right to have different benefit structures for retirement than for death.

PROPOSAL NO. 2C: That the benefit to the mother of a dependent child of a retired worker shall be available only if the child is less than 6 years old or is under a disability that began before age 18. The same benefit should be available to the father of a dependent child.

3. Pre-Retirement Survivor and Disability Benefits

The needs that survivor and disability benefits are designed to fill are basically different from those for retirement benefits. The ages differ, frequency of presence of children differs, and needs for care differ. Hence it is not appropriate to have identical benefit structures and formulas for these quite different situations. Likewise, the different lengths of earnings records suggest a need for different benefit patterns and different numbers of dropout years. This Panel has concentrated on benefits for retirements, and therefore recommends a separate exploration of redesign of survivor and disability benefit programs by a selected group of authorities.

4. Family Maximum Benefits

Use of the recommended averaged AIME's requires suitable adaptation of the family maximum provisions. The Panel believes, furthermore, that the structure of the family maximum should be changed. At present the maximum benefit paid on a single earnings record is approximately 1.75 times the PIA.[4] Under our recommended benefit formula for those with AIME around $300, the corresponding family maximum in the present law is about 1.2 times AIME. The central role of social security benefits as replacement for lost earnings suggests to us that the family maximum should be related to the AIME rather than to the PIA. The former better identifies the level of earnings to be replaced.

PROPOSAL NO. 3: That the family maximum benefit based on the earnings record of a retired worker should be 120 percent of the AIME. The family maximum based on two averaged AIME's should be 240 percent of their average.

This proposal would generate a considerable increase in the family maximum for those with large AIME's, or with averaged AIME's if one spouse had very low or no earnings. This, however, is not a serious objection because of the limit we have proposed for the benefit to a dependent child of a retired worker.

5. Divorced Wife and Widow Benefits

Greater frequency of divorce in our society has increased the magnitude of the problem of individuals of retirement age who have not had substantial earnings records and are also not eligible for spouse or survivor benefits. To ensure availability of some benefits for such people, Congress, in 1965, provided benefits for the divorced wife of a retired worker provided the couple had been married for 20 years immediately before the date of divorce and the woman had not remarried. The benefit is the same as the wife's benefit—the excess of one-half of PIA of the divorced husband over the PIA of the woman. This amount was not subjected to the family maximum. Similarly, a surviving divorced wife is entitled to widow's benefits.

This structure of benefits has several serious limitations. It does nothing to provide benefits for uninsured women divorced after less than 20 years of

[4] The ratio of maximum family benefit to PIA starts at 1.5, rises almost to 1.9, then settles down at 1.75.

marriage. As with the spouse benefit, it provides very different benefits to families that have made similar contributions. Nevertheless, since this Panel's averaging proposal does not ease this problem, we do not have any recommendations on the reform of the benefit. In the long run, the natural solution is development of individual records for all adults in our society, whether workers or not. Such a proposal is made in Chapter 7. Since it would take a long time to build up individual records, it seems necessary to maintain the divorced wife benefit for at least 20 years after the adoption of any decision to build up individual records.

6. Additional Detail on Spouse Benefits

In Section 1 of this chapter proposals on spouse benefits were considered, but only for fully retired spouses both at least aged 65. It is necessary to be sure that the proposals work satisfactorily in other situations. We conclude that they will, provided companion proposals in this section, or others like them, are adopted. We present here possible solutions to questions on actuarial reduction, earnings limitation, adjustments upon divorce, and transition from current law.

a. *Actuarial Reduction.* If a husband and wife apply for benefits at the same time and choose to average their AIME's, a simple procedure would be to calculate the benefit for each by the rule of Proposal No. 1A. The husband's benefit would be reduced if he were less than age 65, and the wife's would be reduced if she were less than age 65. At the death of either, the survivor would receive two-thirds of the family benefit, under Proposal No. 1C. A complication arises when both have received (possibly) actuarially reduced benefits based on separate earnings records, and later choose to average AIME's while still subject to those actuarial reductions. In this case each should receive the amount described by our Proposal No. 1A less two actuarial reductions—first, the actuarial reduction attributable to the individual's previous records, and second, an actuarial reduction (based on the age when averaging AIME's) for the difference between the amount to be received after averaging and the PIA before averaging. Note that this second reduction, might, in fact be an increase.[5]

A further case arises when records are averaged after one spouse has died. To combine the two cases, the surviving spouse should receive two-thirds of the family amount that would be payable if the deceased spouse were still alive and were the same age as the surviving spouse.

b. *Earnings Limitation.* Within the structure of the present earnings limitation there are two questions to be faced in the averaging proposal. When is a worker eligible to average, and how are benefits to be reduced for earnings above the exempt amount? Following current procedure, benefits would be reduced by 50 cents for each dollar earned above the minimum amount. If this reduces benefits to zero, benefits of the spouse would be reduced 50 cents for each additional dollar earned until benefits of the spouse have been reduced to their level if AIME averaging had not occurred.

c. *Divorce and Remarriage.* Upon the divorce of a couple who have averaged AIME's, each could continue to receive the benefits being paid provided they were married sufficiently long (e.g., 20 years or perhaps less).[6] Since averaging of AIME's can only be done once, remarriage creates no difficulties of recomputation. Similarly, remarriage after spouse's death that followed averaging creates no recomputation problems.

One small difficulty comes from the possibility of recomputation after divorce as a consequence of further earnings. Since benefits being received are not

[5] This solution might be clearer in equation form. Denote by HPIA, WPIA, and APIA the PIA's on the individual and averaged records. Let H and W (H + W = 2) be the shares of APIA paid to husband and wife. Then, the husband should receive H × APIA less the actuarial reduction previously incurred on HPIA less the actuarial reduction appropriate for the amount (HPIA − H × APIA) and the age of the husband at the time of averaging. The wife would be treated similarly.

[6] Alternatively, one might have the individuals revert to benefits on their individual records. The procedure in the text assumes unavailability of the divorced wife's benefit (for divorce after averaging).

based on the individual's record, an artificial record must be constructed to enable recomputation to give whatever benefit increase is appropriate. A solution is to multiply the earnings record of an individual by a constant, selecting the multiplier so that the benefit received (ignoring actuarial reductions) equals the PIA based on the multiplied record. If the record is zero, it can be set equal to a constant indexed amount.

d. *Transition From Current Law.* If the proposals in Section 1 are adopted at the same time as the formula of Chapter 3 comes into effect, it will be necessary to adapt the transition rule offered in Chapter 3.

Changing the spouse benefit justifies use of the transition arrangement for the same reasons that changing the basic benefit needs transition. If the spouse benefit should change later, transition can easily be designed; if it should change concurrently with introduction of the price-indexing arrangement, then the two transitions can be combined by use of the rule described in Proposal No. 4.

PROPOSAL No. 4: That the spouse of any worker who is receiving benefits based on old rules be eligible for spouse benefits of present law. A couple may average AIME's and use the new benefit rules if either spouse is receiving benefits based in whole or in part on new rules (making both ineligible for spouse benefits). The spouse of a worker receiving benefits based partly on old rules would be eligible for a spouse benefit based on part of the worker's PIA. The calculation would be thus:

> If the worker's PIA is equal to a fraction, a, of PIA based on old rules (OPIA), and a fraction, 1-a, of PIA based on new rules, the spouse benefit would be the fraction of the spouse benefit that would be available under old rules determined by the relationship {a[½ OPIA (worker)-PIA (spouse')]}.

e. *Other Issues.* The delayed retirement increment creates no complications since the worker can receive the appropriate additional amount for his or her individual earnings record or his or her share of the family benefit.

The computations proposed in this chapter could be made more easily if all were done in dollars of constant (e.g., 1976) purchasing power, adjustments to current dollars being the final step. This would be particularly useful if the proposal on actuarial reduction in Chapter 7 were also adopted. An implication of this approach would be a simple percentage increase for all on the rolls at the time of a cost-of-living adjustment.

In the matter of weighting the benefit formula in favor of low-income workers, the Panel sees three primary reasons for maintaining this time-honored principle in both the basic formula and the extra provision represented by the spouse benefit. First, social concern for wage replacement is greater for income that covers expenditures for items that are necessities rather than luxuries. This makes replacement need greater for those with low than with high incomes. Second, recognizing the social security system as part of our country's general tax-transfer program, it seems to us appropriate to give greater benefits relative to earnings to the low-income people on the same principles that it is considered appropriate to have a progressive income tax.

The third point is that individuals in our economy are subject to considerable uncertainties about the size of income in any year of their working lives. Benefits that vary with averaged earnings (as in present law and our recommendations) help to cushion people against loss of retirement benefits due to particularly low earnings in some years. These three reasons stand behind the design of the benefit formula the Panel favors.

'Old or new PIA, whichever applies.

Chapter 6.—Panel Studies of Earnings Histories

1. Purposes of These Studies

The major data analysis project undertaken by the Panel was classification and modeling of earnings histories of workers. In this project the Panel benefited from many useful ideas given us by members of the technical staff of the Social Security Administration, who also made most of the statistical tabulations for us.

This project had three basic goals. The first was to test the validity of the assumption of constant exponential growth in earnings that has strongly influenced benefit design up to the present. The Panel undertook to examine, by statistical analysis of workers' lifetime wage patterns, how the facts conform to the constant exponential growth rate pattern. Findings from such an analysis can significantly influence benefit design.

The second goal was to develop a pool of statistics and a simulation model that could be used to test alternative benefit formulas.

The benefit formulas examined by the Panel were of two broad types. there were formulas based on short averaging periods, e.g., those based on a worker's highest five or ten years of earnings. Second, there were formulas based on longer averaging periods but with past earnings equalized through an indexing process. To test these formulas, extensive earnings data are needed.

A question about formulas of the first kind is whether the years used for benefit determination are close enough to retirement to reflect consistently the income to be replaced. Distortions arise when periods of highest earnings are close to retirement for some people but distant from retirement for others; workers with identical *real* earnings are likely to get considerably different benefits, those whose highest earnings are closest to retirement being the most generously treated. Consequently it is important to be informed of the distributions of these high earnings years.

In comparing methods for indexing money earnings, the correlation between the average indexed earnings and the average (unindexed) earnings used in present law is of significance. If it is positive and high, it is relatively easy to construct a benefit formula that will produce benefit amounts consistently close to those of present law.

A more important consideration in appropriately adjusting earnings histories by an indexing process is the applicability of the index to various groups of workers. We need to know to what extent using an average rate of wage increase overstates the wage increases for some groups and understates them for others. Hence, the variability of earnings increases needs investigating.

The third goal of the project was to develop methods by which more realistic statistically based earnings histories may be suggested for use in official cost estimation procedures in place of the present official simulation technique.

2. Sources of Data

Much is already known about the distribution of earnings in our national work force. However, most of these figures are cross-sectional, i.e., they tell us about earnings distributions at one particular time. For social security work earnings patterns of individuals over long periods are needed.[1]

Two compilations of data from the ongoing research activity of the Social Security Administration were made available to us. The first was the *0.1 percent Continuous Work History Sample (CWHS).* This sample of random social security numbers provides chronological information on one out of each thousand

[1]Because of absence of sufficient such information, the benefit illustrations in Chapter 3 were constructed principally from census data.

workers with wage histories. The information includes annual taxable earnings and estimated annual total earnings in covered employment for the period 1956–1972. The Panel's work would have been facilitated if a longer continuous record had been available. Information about these seventeen years, years of relative economic stability but with some cycles although no deep economic dislocations, was indeed useful. However, the earnings fluctuations revealed by this sample undoubtedly understate the fluctuations that would mark a major recession.

The second source of data consisted of two random samples of benefit awards made in 1974: the first, 8,399 awards spread over July–December; the second, 3,501 awards in December. These samples were helpful in confirming results derived from the CWHS. The tables and charts in Appendix A all come from CWHS figures.

The CWHS figures and the samples unfortunately give limited information about the people in the sample. Our classifications and models were, on this account, necessarily based on age, sex, and wage history only. Additional particulars would have been analytically useful.

3. Derived Statistics

The data were used to develop graphical displays and tabulations that led to further classifications and modeling. Computer-produced graphs of wages subject to payroll tax and of real wages (adjusted by CPI) for workers in the CWHS file born in 1909, 1919, and 1924 were studied. A crude review of these graphs (see samples in Figures 6–1, 6–2, 6–3, and 6–4) revealed that about half of the male workers enjoy steadily increasing wage trends. A more important conclusion was that wage histories suffer from great variability.

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Figure 6-1

Steady Rising Pat.ern Male Worker Wage History:
Born 1909, Consistently at the Taxable Maximum

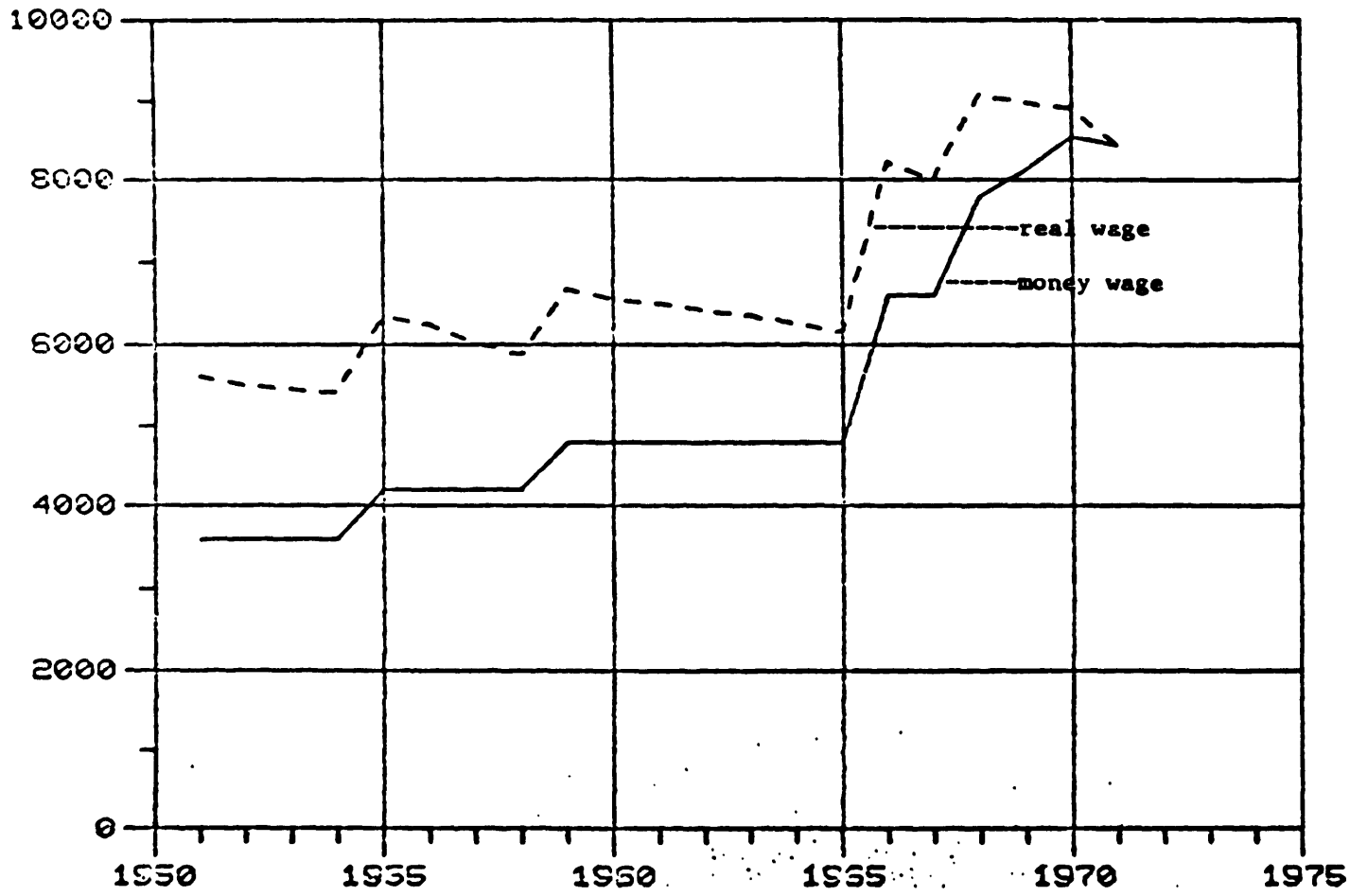


Figure 6-2

Irregular wage history, but rising trend
Male worker born 1909

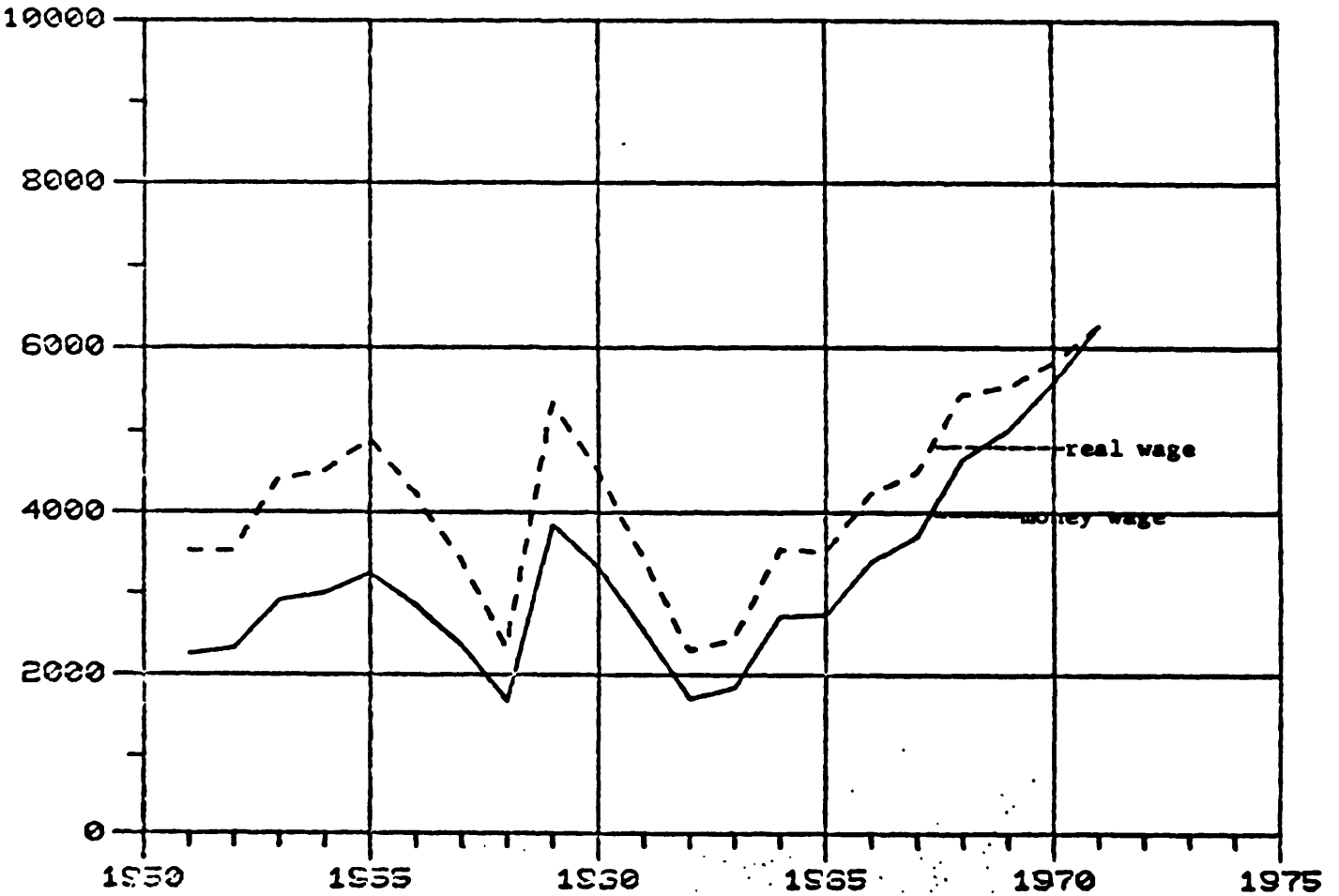


Figure 6-3

Irregular wage history, no clear trend
Male worker born 1909

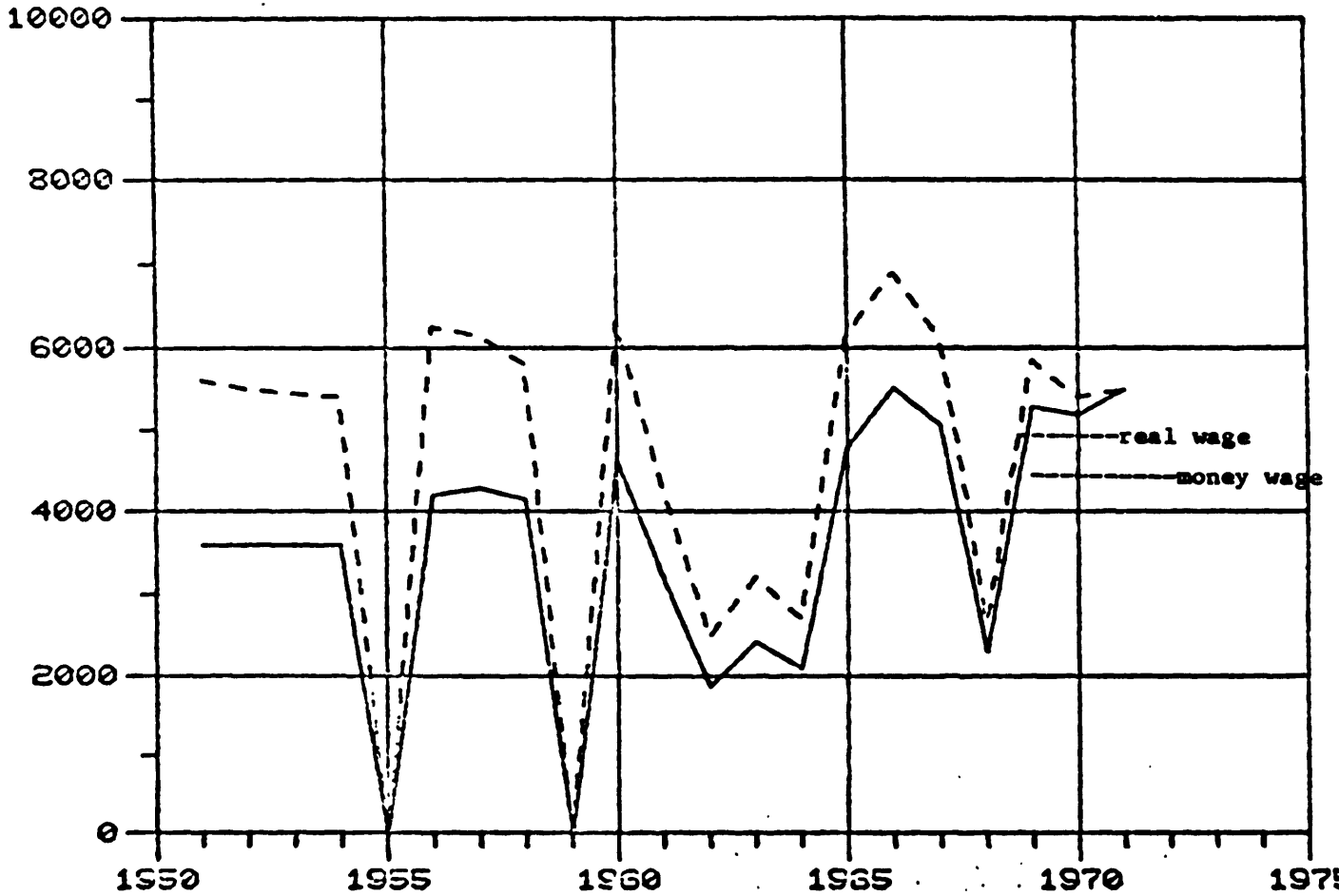
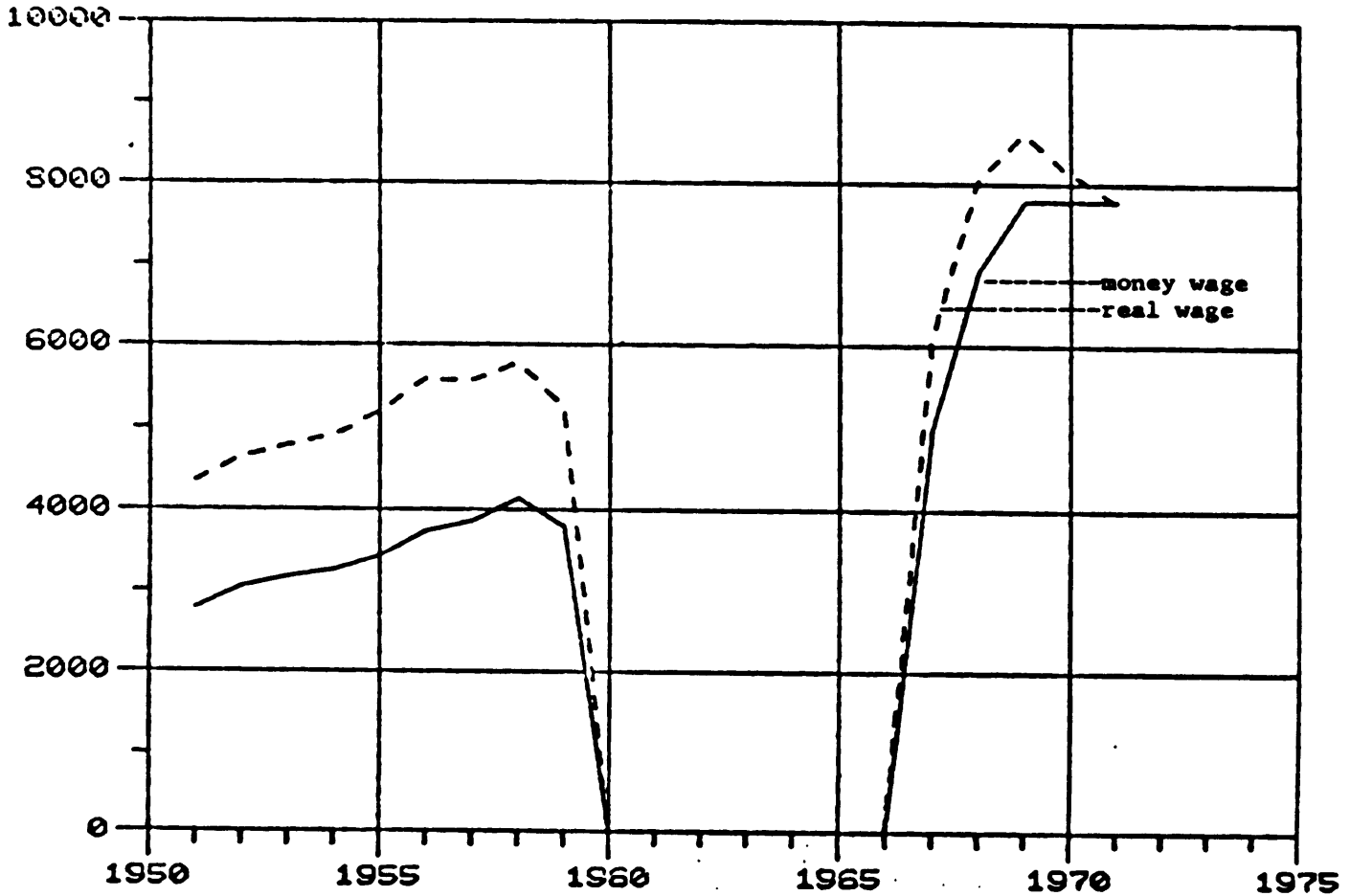


Figure 6-4

Female worker wage history: born 1924



Next, a series, as follows, of six basic types of analysis were made:

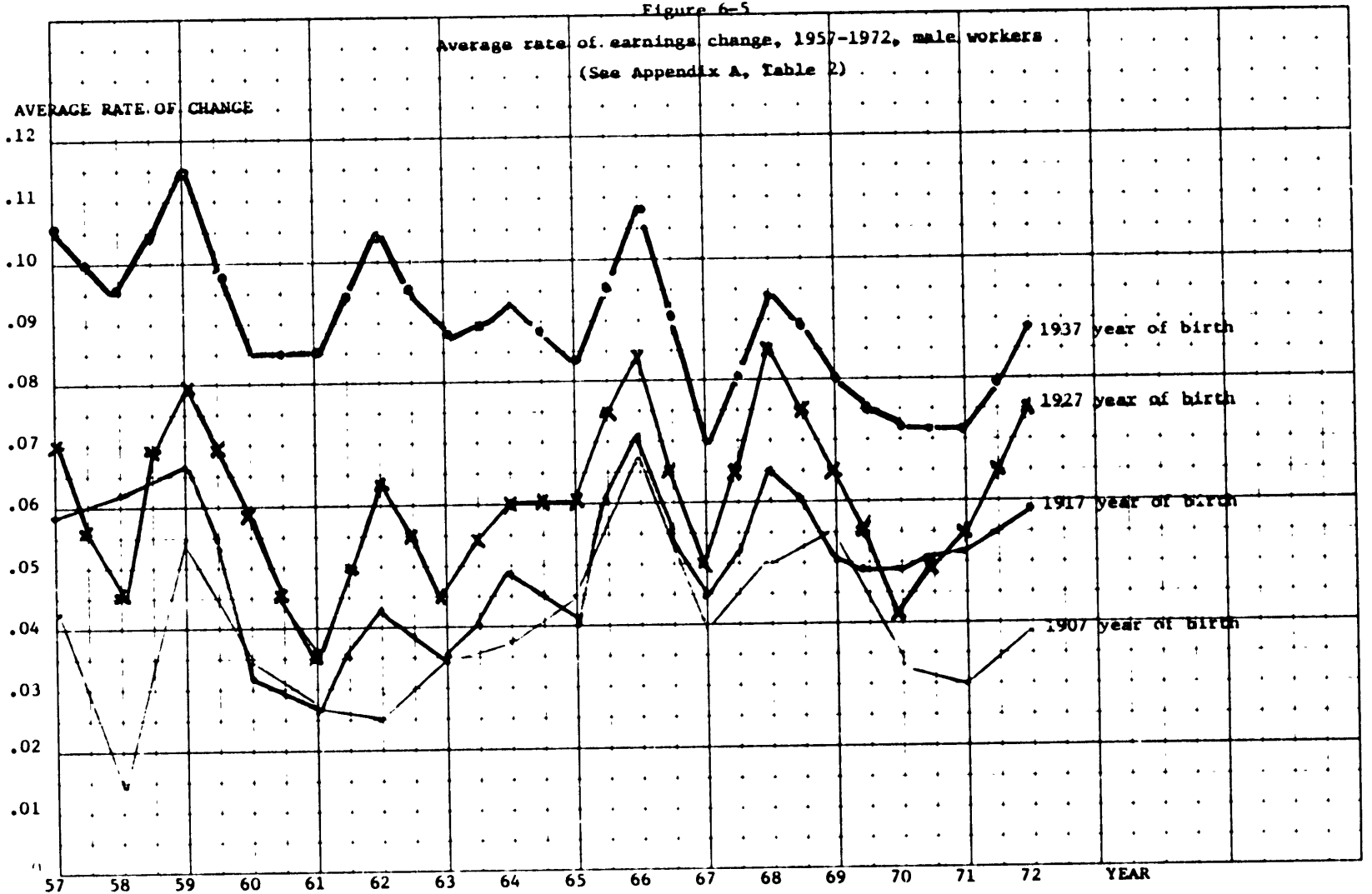
a. Annual rates of change in total estimated earnings (Appendix A, Section 1) for a sample from birth cohorts 1907, 1917, 1927, 1937 were tabulated. The average annual rates of change through 1957–1972 within these cohorts (excluding workers with zero earnings and extraordinary earnings changes) and their standard deviations were calculated. The principal conclusions are that rates of changes are higher for younger workers than for older workers and that there is much variation in wage change rates, both for specific people from year to year and among different people. See Figure 6–5 for an example of this analysis.

b. Analysis, with similar exclusions, was made of rates of change in estimated total earnings of workers who were persistently within low, middle, and high earnings groups. The principal conclusions from the prior analysis were reinforced. It appears also that workers with higher earnings have larger average rates of increase. Figure 6–6 summarizes the results for average rates of earnings change for workers persistently in the lowest one-third, the middle, and the highest one-third of earnings within year of birth and sex groups. This complete analysis appears in Appendix A, Section 1.

Figure 6-5

Average rate of earnings change, 1957-1972, male workers

(See Appendix A, Table 2)



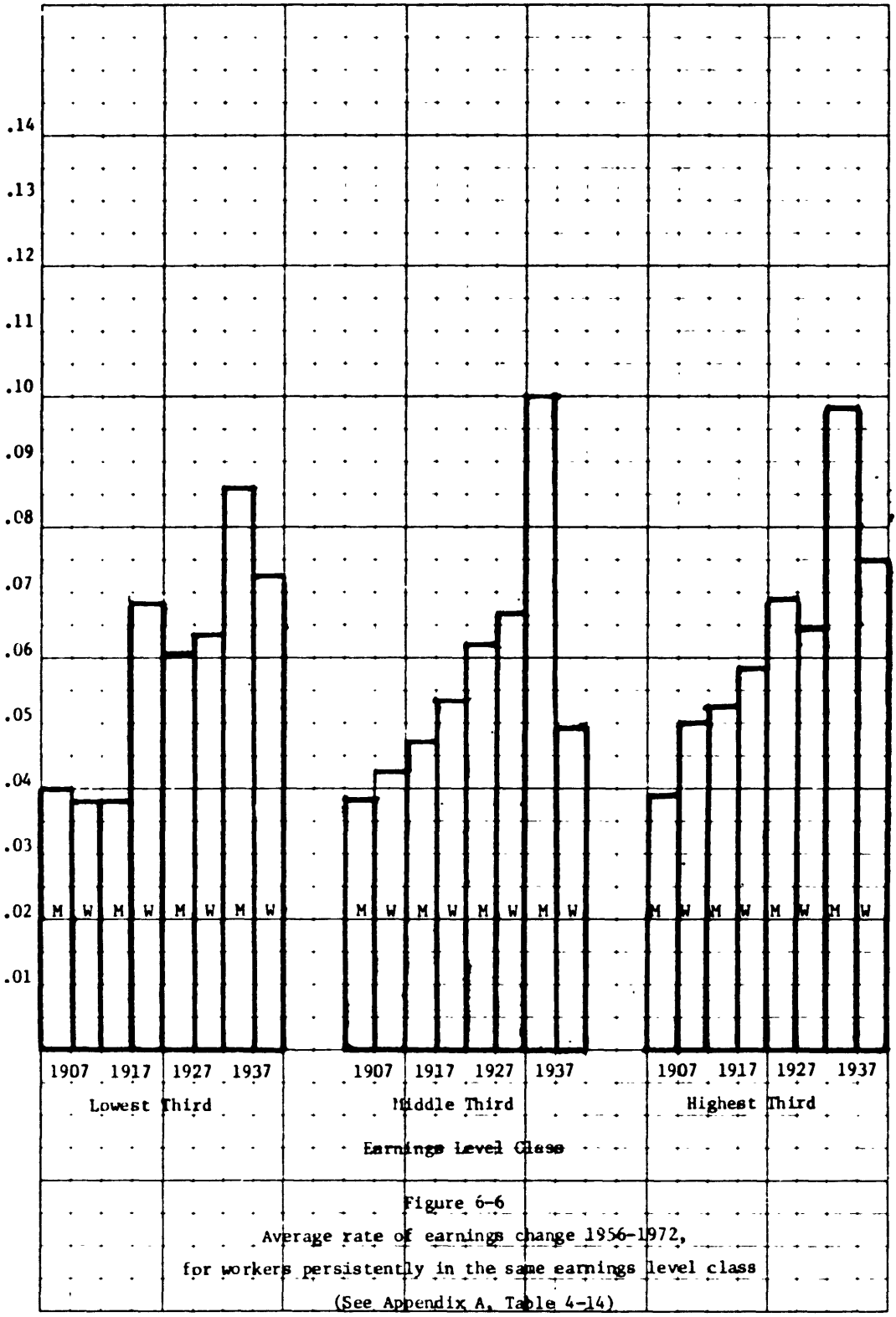


Figure 6-6

Average rate of earnings change 1956-1972,
for workers persistently in the same earnings level class
(See Appendix A, Table 4-14)

c. The years of peak earnings for categories of workers born in 1906 and 1907 and retiring in 1968, 1969, 1970, and 1971 were studied (Appendix A, Section 2). The principal finding is that within retirement year, age, and sex groups, the years and ages of peak earnings are widely spread. Several years separate the average years of peak earnings from the retirement year. Table 6–1 summarizes these results.

TABLE 6-1. - DIFFERENCE BETWEEN YEAR OF RETIREMENT AND AVERAGE YEAR OF PEAK EARNINGS [1]

Year of birth, sex and year of retirement	Money earnings	Real earnings
1906		
Male		
1968	4 8	5 8
1969	2.4	4 1
1970	4 5	6 1
1971	3 2	5.7
1972	6 0	7.0
Female		
1968	5.2	6 2
1969	3.0	3 9
1970	3 5	5 1
1971	2 3	3 7
1972	4 9	6 5
1907		
Male		
1968	1 5	6 5
1969	5 1	6 3
1970	3 8	6 3
1971	3 9	6 2
1972	3 7	6 3
Female		
1968		
1969	4 5	5 8
1970	2 4	4 0
1971	3 5	5 1
1972	3 7	5 4

[1] Assuming retirement at mid-year derived from Appendix A, Tables 15 and 16

d. The frequency of occurrence of a decline of at least 10 percent in annual estimated earnings subject to a hypothetical taxable maximum consistent with present law was tabulated (Appendix A, Section 3). Earnings decline greater than 10 percent is found to be very common.

e. Tabulations were made of the calendar year closest to, and also farthest from, retirement among the five years of highest earnings. Contrary to customary assumptions, fewer than half the workers in this sample experience highest earnings in the last year before retirement. The distribution of earliest calendar years of the worker's five highest earnings years is diffuse. This analysis is reported in Appendix A, Section 4. Figure 6–7 summarizes some of the results.

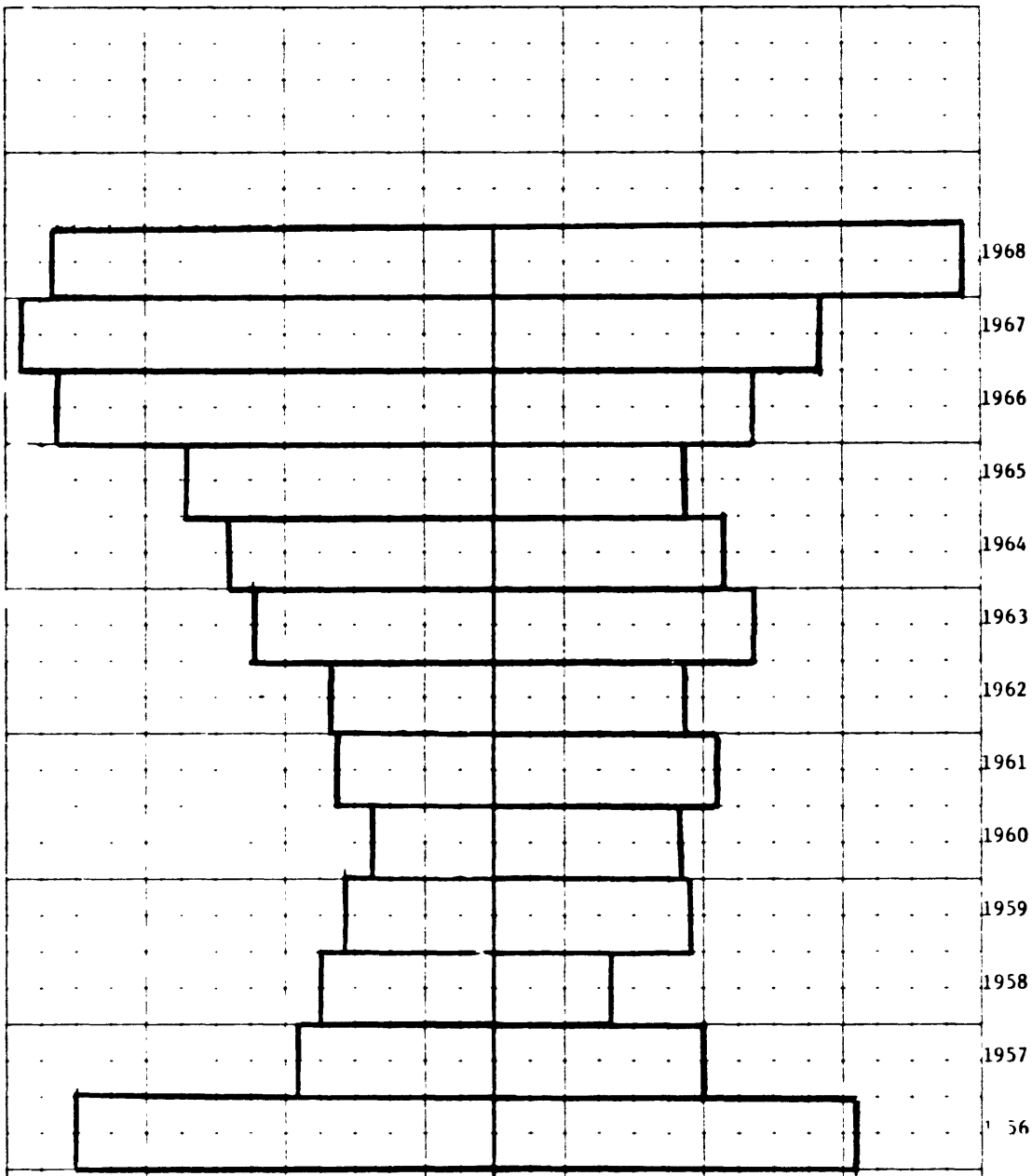


Figure 6-7

Distribution of earliest year of high 5 years of estimated earnings, limited by automatic adjusted(hypothetical) maximum 1906 and 1907 year of birth, retired lives by 1972.
(See Appendix A, Table 20)

f. The numbers of years in which earnings were at the hypothetical taxable maximum were studied. It is observed that earnings of by far the majority of workers do not reach the taxable maximum for even a single year and that the numbers of years in which others achieve the maximum are widely spread. These results are reported in Appendix A, Section 5. Table 6-2 shows some results.

TABLE 6-2. DISTRIBUTION OF YEAR OF BIRTH AND SEX COHORTS BY YEARS WITH ESTIMATED EARNINGS AT OR ABOVE THE AUTOMATIC ADJUSTED (HYPOTHETICAL) TAXABLE MAXIMUM, 1956-72

Number years at maximum	Men—Year of birth				Women—Year of birth			
	1907	1917	1927	1937	1907	1917	1927	1937
0 to 1	0.708	0.639	0.375	0.671	0.966	0.980	0.987	0.987
2 to 5	.097	.104	.176	.178	.012	.009	.007	.009
6 to 9	.067	.074	.102	.119	.010	.007	.003	.003
10 to 13	.044	.055	.097	.030	.011	.003	.001	.001
14 to 17	.085	.128	.110	.002	.001	.002	.001	.000

Note: Derived from Appendix A, Table 21.

The Panel found that most men and women do *not* have wages that grow at a constant exponential rate. Instead there is great variability in wage-growth rates among American workers. Money wage declines greater than 10 percent from one year to the next are common. Years of peak earnings are widely spread. Most important, the rate of change in earnings varies substantially by age. Between ages 20 and 35 earnings growth rates for men are high; the average rate of change at these ages is much greater than the average for the total male labor force. Between ages 35 and 55 the growth rate declines to the average rate for all male workers. After age 55 the growth rate seems to fall below the general average.

In summary, these tabulations point to serious difficulties with any formula that relates benefits to five (or ten, etc.) years of highest earnings, in a social insurance system that embraces so many workers with sporadic earnings and with declining earnings shortly before retirement. The tabulations show also that earnings growth rates vary greatly by age and, even within a sex and birth-year group, are highly variable. This strongly suggests that use of a single wage index for creating individual wage-indexed earnings histories will not reflect relative earnings histories as satisfactorily as has been believed.

4. Classification

The tabulations and displays just outlined (and described in detail in Sections 1-5 of Appendix A) provide insights into earnings variability in the United States. They also identify problems in using benefit formulas of certain types. They show that average wage rates conceal many complex wage patterns. However, they do not permit the classification of earnings histories.

Appendix A, section 6, gives results of a classification study made on a set of wage-indexed earnings histories selected from the CWHS sample. The classification system was developed by Hermann Grundman of the Social Security Administration. The system involves three dimensions: (1) the average level (high, middle, low), (2) the trend (increasing, level, decreasing), (3) the profile (sag, linear, hump).

The results for men in each of three birth cohorts (1910-11, 1920-21, 1930-31) are presented in the Appendix A. The principal conclusions are:

a. Distributions among the middle and high earnings classes within each profile and trend classification are similar to each other.

b. Distributions within the low earnings group are different from those in the corresponding middle and high earnings groups. This is probably due in part to the many gaps in wage records in the low earnings group.

c. The "level linear" and "increasing linear" groups do not dominate the classification—in fact, are much smaller than appears generally to have been believed.

d. The youthful cohort shows the highest proportion of people whose wage-indexed earnings trend upward.

5. Correlations Among Wage Histories

Each of the benefit formulas considered by the Panel involves some form of earnings averaging. Differences among them are in the lengths of the averaging period and the weights employed. To gauge the problems of transition from one benefit formula to another, the equivalence between average earnings computed under present law, under a price-indexed formula, under a wage-indexed formula and under High-10 and High-5 formulas, were studied. For this the earnings histories in a random CWHS sample of 4,320 workers were used.

The coefficient of correlation used in table 6-3 that follows is the normal statistical measure of relationship such that a value of 1.0000 marks perfect linear relationship and a value of 0.0000 shows that the items compared are varying completely independently. Increasingly negative values portray inverse relationships.

TABLE 6-3.—COEFFICIENTS OF CORRELATION BETWEEN THE AVERAGE MONTHLY WAGE CALCULATED UNDER VARIOUS ALTERNATIVE BENEFIT FORMULA: TOTAL (4,320 LIVES)

	Price indexed	Wage indexed	High 10	High 5
Current law	0.9947	0.9794	0.9739	0.9683
Price indexed		.9943	.9605	.8819
Wage indexed			.9363	.8476
High 10				.9672

These results lead to the conclusion that a price-indexed formula produces results more closely correlated with the present law than the other systems do.

6. Regression Model

To fill the need that exists for simulating earnings histories, experiments were conducted with several statistical models developed from CWHS data. Although the CWHS lacks information on many useful variables, such as occupation and education, which others have found helpful, the earnings, age and sex data were available to develop parameters. Regression models were developed for male lives using the logarithm of wage-indexed earnings as the response variable and age and individual dummies as independent variables.

Details of this modeling effort appear in Appendix B. The typical lifetime profile of wage-indexed earnings that emerged is shown in Figure 6-8.

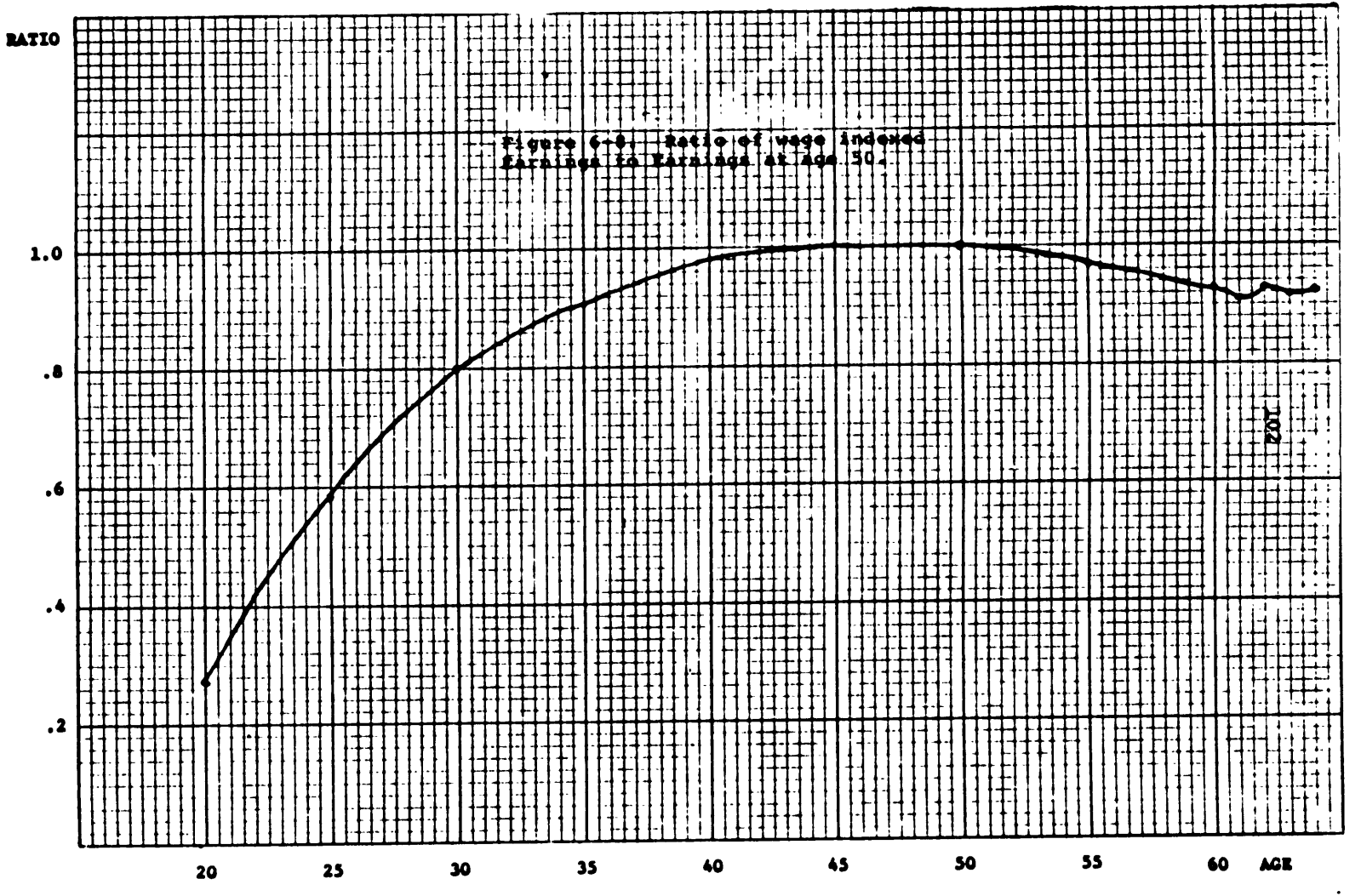


Figure 6-8. Ratio of wage indexed earnings to earnings at age 50.

In addition, a simple probability model for simulating the occurrence of zero earnings and return from the zero earnings state was constructed.

The principal conclusions drawn from this whole project are:

1. Rates of change in earnings are high at ages 20 to 35.

2. Rates of change in wage-indexed earnings are not large beyond age 40.

3. There is much variability, particularly for low earners, around the response variable (earnings).

4. The probability of zero covered earnings in the year that follows any year of positive earnings proves to be 3 percent. This is consistent with the finding that approximately 60 percent of men in the sample had a full 16 years of positive earning in the 16 years examined.

5. The random influences upon wage growth have important bearing upon the effect of lengthening the average period in benefit computation. (This lengthening will occur under present law or under either of the indexing proposals under consideration.)

Chapter 7.—Other Issues

In this chapter the Panel makes firm recommendations, or in some cases sets forth general proposals, on several additional issues. These issues are:

1. The earnings test
2. Actuarial benefit reduction at early retirement
3. Benefit increment upon delayed retirement
4. Tax rate for the self-employed
5. Universal coverage
6. Establishment of earnings records for all potential beneficiaries
7. Income taxation of benefits
8. Size of Trust Fund
9. Benefit computation in event of prolonged recession

1-3. Earnings Test, Benefit Adjustments for Early or Late Retirement

The earnings test is controversial. Its provisions are accepted reluctantly even by many who clearly recognize that the system is an earnings replacement instrument, and that imposition of the test permits greater benefits than otherwise could be paid to those who have experienced earnings decline as a consequence of retirement.

The difficulty in formulating a suitable and acceptable earnings test is that there are several quite different personal circumstances to which it will apply. There are people whose choice is between complete dependence upon the benefit and finding part-time work. There are people whose Social Security benefit is relatively large but whose income decline upon retirement would be so large that for them there are major living standard adjustments in store unless the benefit can be supplemented. There are people whose incomes from private pensions and personal savings are so substantial that it would be unreasonable for a social insurance system to permit material employment earnings as well as providing cash benefits. There are people willing and able to stay in the labor market provided the terms on which this can be arranged appeal to them as reasonable in contrast to their resources in retirement.

A companion difficulty lies in the changing conditions of the national economy. At some times more than at others there will be special advantages to society to encourage elderly people to exercise their productive capacities.

Any test of current earnings in the determination of benefits creates some degree of incentive for the recipient to retire, fully or nearly so. Benefit design must attempt to strike the best balance between greater benefits to those unable to supplement their income and a wider spread of benefits among all the elderly. Unfortunately too little is known of the manner in which those affected by the earnings test arrive at their decisions to seek or not to seek employment.

Because benefit levels are related to the age at which benefits start, the formulas for determining benefits in event of early or late retirement are intertwined with the earnings test. At present, each month of continued work beyond age 62 increases the benefit by somewhat less than 1 percent until age 65, apart from benefit changes due to the additional years of earnings. For someone not claiming benefits between ages 65 and 72 each month of deferment creates a retirement increment of 1/12th of 1 percent beyond the age 65 value. These two provisions generate incentive to continue working which partially offsets disincentives of the earnings test. Again, very little is known about how workers would respond to different percentage increases in benefits as a consequence of additional months of work.

These issues are important and will become even more so early in the next century when the ratio of retired people to workers is expected to increase sharply. It is necessary, if the benefit provisions of Social Security are to fit the

needs of society, to discover how and to what extent decisions of the elderly to withdraw from and return to the labor market are affected by those provisions. We need to know, first, the influence of Social Security on the decision to retire, and, second, the effect of the earnings test on the decision whether to keep one's income below a specific level or to seek and accept employment opportunities after qualifying for the retirement benefit.

Efforts to throw light upon these questions have been made many times. Alicia H. Munnell[1] has listed the evidence assembled through surveys and by statistical procedures, has found the results puzzling and conflicting, has emphasized the hazard of relying upon interview results, and has cited general support for the idea that the provisions determining benefits have had impact on the supply of labor of older workers. It is fair to suppose that historical studies have shown lower impact than applies today and will apply in the future because benefits have grown much larger than was the case earlier. In the past five years the average benefit being paid to a retired worker has grown from $118 to $207; that to a wife or husband from $59 to $105.

Hence we urge that more information be gathered on the determinants of retirement. We consider this an area in which a social experiment would be rewarding, following the experiments made to learn about negative income tax and health insurance.[2]

THE PANEL'S RECOMMENDATION: That Congress fund a "social experiment" financed by the OASI Trust Fund to examine responses of older workers to different earnings tests, different sizes of actuarial reduction for early retirement, different delayed retirement increments, and variations in other benefit provisions that may influence retirement decisions.

While the Panel has not designed such an experiment, we envision it as being along the following lines. A random sample of Social Security numbers stratified by age and sex for people ages 57 to 60 years would be selected. Those chosen and their spouses would be offered the opportunity to participate permanently in the social experiment. This participation would have to be made attractive to generate participation. Questions about personal, financial, health, and work circumstances would have to be answered. In this way several designs could be tried, and their effects examined. Information would begin to be available by the mid-1980's, giving ample time to redesign these provisions before the expected drastic rise in the ratio of retired people to workers early in the next century.

We recognize that some important influences upon retirement status, such as mandatory retirement ages, would limit the freedom of decision generated by this social experiment. Nevertheless, much useful data could be expected from it.

Revealing the effects of strengthening or weakening particular present benefit provisions would be the first task of the social experiment. In addition, however, it affords opportunity to test alternate designs. Possibilities include the following: Consequences of providing part of benefits without any earnings-test limitation could be discovered. Responses to taxation of all or part of retirement benefits could be ascertained. Another possible experiment would be replacing the present abrupt removal of the earnings test at age 72 by a gradual easing of the test during the ten years through which it now operates. The benefit might be related to the size of the decline in earnings as well as to their level.

This Panel concurs in the recommendation of the latest Advisory Council that the earnings test should be annual, not monthly. We believe that the purposes served by the monthly test are insufficient to offset the unfairness that arises because some people have greater opportunities than others to time their

[1] *The Future of Social Security*, Alicia H. Munnell, Boston (forthcoming from Brookings Institution).

[2] Discussions of social experiments can be found in (1) J. A. Pechman & P. M. Timpane: *Work Incentive and Income Guarantees The New Jersey Negative Income Tax Experiment*, (Brookings Institution), (2) E. M. Grambich 2 P. P. Koshel: *Educational Performance Contractors An Evaluation of An Experiment*, (Brookings Institution), (3) John P. Gilbert, Richard J. Light & Frederick Mosteller: Assessing Social Innovations—An Empirical Base for Policy" in *Benefit-Cost and Policy Analysis, 1974*, (Richard Zeckhauser *et al*, Editors).

earnings to their own advantage. We note also that useful administrative simplicity can be accomplished by the recommended change.

A pair of different questions about the early retirement adjustment are (a) whether the "5/9 of 1 percent per month" actuarial reduction ratio needs to be changed, and (b) how a cost-of-living increase should be computed for people whose benefits have been subjected to the actuarial reduction. The Panel has looked at both these questions.

With respect to (a), we recognize that there are philosophical and mathematical considerations involved. We propose that the former be explored through the social experiment and that the latter be examined in conjunction therewith.

As to (b), it seems to us that a change in the present method of granting cost-of-living benefit increases to people whose benefits began before age 65 is desirable on equitable grounds and in the interests of simplicity. The present rule is that the original benefit before actuarial reduction is increased proportionately to the increase in CPI, and then the original *amount* of actuarial reduction is subtracted. We propose instead that the original reduced benefit be increased proportionately to the increase in CPI, an arrangement consistent with the Panel's general recommendation that purchasing power of benefits be maintained.

4. Tax Rate for the Self-Employed

When the self-employed were first included under Social Security, they were subject to a tax equal to three-quarters of the combined employer-employee rate. Under present law, the self-employed are, and will continue to be, subject to an OASDI tax rate of 7 percent, which is somewhat less than three-quarters of the total rate applicable to employee earnings. For reasons to be discussed, we join the Advisory Council in urging a restoration of the three-quarters relationship.

THE PANEL'S RECOMMENDATION: That the tax rate for the self-employed be three-quarters of the combined employer-employee tax rate. Our analysis leading to this conclusion is limited to OASDI, but we see no reason why the three-quarters rate should not apply to hospital insurance also.

Ideally, the Social Security system should treat the self-employed comparably to employed workers, recognizing a self-employed person is both employer and employee. When the payroll tax and current personal and corporate income taxes are considered together, this is approximately achieved by the three-quarters rule, but is not achieved by the present 7 percent tax rate. To see this, let us examine the tax treatment of the payroll tax for an employed worker. Assume that an individual's wage is w (which is below the maximum taxable earnings base). Assume that the employee pays a payroll tax at the rate t. Then tw is collected in Social Security contributions from the employee and the amount w is subjected to the personal income tax. The employer also pays a tax of tw. For the employer's income tax (whether personal or corporate) the total expense, (w+tw), is deductible as a business expense. Thus, if s is the employer's income tax rate, then the cost (net of income tax) of the two parts of the payroll tax is $w[+(1-s)t]$.

Now let us consider a self-employed person with self-employment income w, i.e., the same earnings for the year. He is subject to a self-employment tax of t' and all his income w is subject to the personal income tax. If the labor of each of these two individuals is to be subjected to the same tax burden, then we need t' to equal $t+(1-s)t$. At present, while the income tax rate for the employers of most employees is close to 50 percent, the proposed rule approximately achieves the desired even treatment.

Admittedly this approach does not provide the Social Security Trust Funds with the same income on behalf of employees and self-employed, but that is an issue between the Trust Fund and the Treasury, not between the Trust Fund and the self-employed.

5. Universal Coverage

It is widely accepted that low-paid people have the greatest replacement needs. This Panel has followed the existing Social Security system in recommending that benefits relative to earnings decrease as earnings increase. This being the case, it is a serious weakness when these relatively larger benefits accrue to workers who have small earnings records only because they have worked in uncovered employment for most of their careers. It is estimated that 40 percent of persons receiving Civil Service Retirement Benefits are currently receiving benefits under Social Security.[5]

RECOMMENDATION: This Panel adds its voice to the widespread call for universal coverage. Particularly, government employees should be included in Social Security.

A paper prepared for the latest Advisory Council pointed out that in December, 1973, there were an estimated 8.7 million jobs not covered, 10 percent of the total. Of these, 0.4 million people were in Federal employment, and 4.2 million were in job categories for which coverage continues to be optional.[6] The most urgent need is to remove as rapidly as possible the opportunities for people to stay out of the system while qualifying for other forms of government pension, and then, having so qualified, to enter the system for a relatively brief time, reaping the special benefit advantages that were intended for, and can be justified only for, low-paid workers.

6. Earnings Records for all Potential Beneficiaries

This Panel proposes that consideration be given to establishing individual records for potential beneficiaries who are not in covered employment.

The primary but not the sole value of such records is for the equitable arrangement of benefits after divorce.

We have recommended in Chapter 5 that benefits in a family be double those that would emerge if each of the couple had developed one-half the *sum of the average earnings* of the members of the couple. We had rejected as an alternative the averaging of their combined earnings taking each year separately through the averaging period. The following are primary reasons for rejecting this alternative.

Consider the simplest case—a couple with just one earner. Suppose that the wife has worked in covered employment while the husband has not. Presumably benefits should start when the wife retires.

But if earnings have been divided annually and the husband is older than the wife, benefits often would start before the wife has retired. Conversely, if the wife were older than the husband, her retirement would result in benefits based on only one-half her earnings records, which by definition would be inadequate replacement for her earnings until her husband also has reached retirement age. This flaw, which arises whenever husband and wife have different earnings records and different ages or times at which they must or would like to retire, seems sufficiently serious to rule out annual division of earnings records for married couples.

It is possible, although the Panel has no present recommendation in this area, that the existence of records for all potential beneficiaries could lead to a system for taxing those not in covered employment in order to generate suitable benefits therefrom.

A possible form of this proposal may be stated thus: Every married person under age 65 and not retired (or disabled) would be assumed to earn at least half

[5] James R. Storey: Public Income Transfer Programs: The Incidence of Multiple Benefits and the Issues Raised by Their Receipt, Paper prepared for Subcommittee on Fiscal Policy of the Joint Economic Committee.

[6] See p. xvi of the *1975 Advisory Council Report*. The Council estimated extension of compulsory coverage to Federal Civil Service and non-covered State and local employees would result in a reduction in taxes of about 0.25 percent of taxable payroll for OASDI and 0.10 percent for the Hospital Insurance program.

the taxable earnings of his or her spouse. If assumed earnings exceed actual covered earnings, the excess would be taxed[8] just as if the person were self-employed. The earned income credit of the personal tax could be expanded to offset these additional taxes for low income families and to cover childless families as well as those with children. (It should be noted that this proposal does not call for taxing spouses according to some measure of the value of household services rendered; the purpose in taxing them is purely to finance a suitable level of benefits.)

7. Income Taxation of Benefits

At present, Social Security benefits are free of income tax. This Panel believes that greater fairness in treatment of different people could be accomplished if benefits were to be partially taxed, the revenue therefrom reverting to the Trust Funds to permit payment of larger benefits.

It has been drawn to our attention that very few among a long list of countries exempt social insurance benefits from income taxation.

The point is that the benefit structure itself is and can be only partly successful in giving relatively larger benefits (per dollar of contribution) to low income people. This failure arises partly because some people are in covered employment during only fractions of their careers, partly because outside wealth is not taken into account, partly because some are and some are not beneficiaries of private pension plans.

The income tax and the social insurance system both attempt to discriminate according to relative abilities to contribute to government revenues, and each by itself is only partly successful in doing so. Close examination of the possibilities may show that combining the two methods of evaluating who is rich will give a better measurement than the sum of these two currently unrelated measures.

The Panel does not propose that benefits for those already retired be taxed; furthermore, imposition of taxes on benefits of those retiring in the future should in our opinion be coordinated with the benefit formula so as to accomplish the increased equity that this proposal contemplates.

8. Size of the Trust Fund

Two separate issues arise in determination of the desired pattern for the OASDI Trust Funds. One issue is whether a large permanent fund should be built to encourage capital formation in the economy. This Panel doubts that the Social Security program is an appropriate vehicle for managing capital formation in the United States. A second issue is whether a fund should be built up in advance of the demographic swing next century to cushion a large increase in the payroll tax. The Panel believes that such a fund is justified and probably will result from the 10.2 percent payroll tax rate we are recommending.

The current Social Security program doubtless has had some effect on the accumulation of capital in this country's economy although the magnitude is unclear. If benefits were fully funded, the Trust Fund would, we understand (by one definition of the words "fully funded"), approximate 2.4 trillion dollars. This represents considerably more savings than workers would have voluntarily undertaken.

Absence of such a fund reflects the size of the benefits that have been granted to beneficiaries (past, current and future) over and above their contributions in taxes. Thus, the system has operated, and will continue to do so, as a transfer mechanism of immense size affecting private consumption and individual savings.

Nevertheless, any decline in capital formation as a consequence of this mechanism is a legitimate result of society's role in aiding the elderly, not a situation for which the Social Security system should be criticized. If there is too little capital accumulation, solutions can be sought through a mixture of fiscal

[8] Whether such tax would be required or optional is one of the questions that would arise.

and monetary measures unassociated with the social insurance system. A flat payroll tax levied for the sole purpose of inducing capital formation would be unduly regressive.

This Panel expresses no opinion on the adequacy of the current and prospective levels of capital formation, but takes this occasion to draw attention to some useful references on this important subject.[6]

This Panel's payroll tax recommendation is for scheduling a level tax rate of 10.2 percent into the indefinite future even though figures suggest that rates somewhat below this may be sufficient to pay retirement benefits having purchasing power as great as or greater than those now being paid. This means that between now and the end of this century the OASDI Trust Funds may experience considerable growth unless benefits are increased. Studies should be undertaken to show what measures by way of benefit increase may be appropriate in the interests of the beneficiaries and to prevent inordinate Trust Fund growth. It should be recognized that a purpose of the Trust Funds is to make abrupt changes in tax rates unnecessary.

9. Benefit Computation in Event of Prolonged Economic Decline

In Chapter 3, this Panel's recommendation of a price-indexed benefit structure was tempered by the observation that such a system would be stable and within financial capability only if wage increases in general outstrip price increases in the economy of the country. We now offer a suggestion on what measure should be taken if that condition does not exist, i.e., if a prolonged recession results in material excess of price over wage increases, generally described as negative real wage growth.

There are two decisions to be made in prescribing for such an eventuality in the Social Security law. The first is to define the circumstances under which a change in the benefit formula ought to be made. The second is to state the nature of the benefit formula change.

RECOMMENDATION: This Panel's recommendation is that changes in (a) the provision for benefit increases to people already retired and (b) progression of the formula bend-points,[7] should be provided for if economic conditions become such that in a period of five consecutive years the ratio of the national wage index to the Consumer Price Index is less than the same ratio of the immediately preceding year at least four times.

If the condition just described occurs, and while it continues, our proposal is that these increases be limited to the proportion of the rise in the national wage index instead of to the proportion of the Consumer Price Index rise. This proposal is meant to cover a period long enough for redesign of the system in the light of events occurring and foreseen at the time.

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[6] a. Feldstein, Martin: "Toward A Reform of Social Security," *The Public Interest*, summer 1975.
b. Munnell, Alicia H.: *The Future of Social Security*, Chapter VI. (Forthcoming from Brookings Institution).
c. Lesnoy, Selig D. & Hambor, John C.: "Social Security, Saving, Capital Formation," *Social Security Bulletin*, July 1972.

[7] And the associated benefit constants.

Appendix A

WAGE HISTORIES AND CLASSIFICATIONS

Section 1. Rates of Earnings Change

Tables 1, 2, and 3 were derived from an analysis of the estimated total earnings for the 1907, 1917, 1927, and 1937 year of birth cohorts represented within the 0.1 percent Continuous Work History Sample (CWHS). Total annual earnings are estimated for those who exceed the taxable maximum by use of a standard estimation technique that is a function of the calendar quarter within which the maximum is exceeded.

In order to make certain that the annual rate of change is defined, and that measures of variability are not unduly affected by a few cases with extremely volatile earnings, certain exclusions were made. For each pair of years entering a rate of change calculation, workers with zero estimated total earnings in either year and those whose earnings increased by more than 50 percent or decreased by more than 33 percent were excluded. Earnings in the year of death or disability were set to zero. Workers with very low Average Monthly Earnings (AME) were excluded under the proposition that, since they are probably part-time or sporadic workers, their presence would obscure wage patterns of those with more direct attachment to the labor force. The cutoff point was set to exclude workers with AME at or below $76. This point was fixed to be consistent with the AME required for a minimum benefit.

Certain observations may be made with respect to these tables:

(1) The declining number of workers that enter the computation, as time advances, from among the 1907 cohort is obvious from table 1.

(2) The entry of the 1937 cohort into the labor market as time goes on is also clear from table 1.

(3) From Table 2, it appears as if average rates of earnings increase are higher for young workers, the 1937 cohort, than older workers, the 1907 cohort.

(4) Table 3 measures the variability of annual rates of earnings change using the standard deviation of the annual rates of change as the measure. It appears as if young workers (1937 cohort) have greater variability in annual rates of change than other cohorts. Even when the sample has been censored to exclude extreme rates of earnings change, it is clear that there is a great deal of variability in earnings change rates.

SEC. 1 RATES OF EARNINGS CHANGE

TABLE 1 NUMBER OF WORKERS IN EACH YEAR'S COMPUTATIONS

Year of birth, Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965
1907 Male	629	599	609	601	581	570	565	539	532
Female	238	252	259	265	265	269	270	263	266
Total	867	851	868	866	846	839	835	802	798
1917 Male	728	749	751	747	765	748	733	738	728
Female	251	263	259	290	298	309	333	335	338
Total	979	1 012	1 010	1 037	1 063	1 057	1, 066	1 073	1 066
1927 Male	772	781	804	812	815	820	833	833	836
Female	182	196	193	204	213	246	263	265	279
Total	954	977	997	1 016	1 028	1 066	1, 096	1 098	1 115
1937 Male	312	560	532	577	615	626	697	710	762
Female	170	207	210	199	210	213	205	197	220
Total	482	767	742	776	825	841	902	907	982
Total	3, 282	3, 607	3 617	3, 695	3, 762	3, 803	3, 899	3, 880	3, 961

TABLE 1[1]—NUMBER OF WORKERS IN EACH YEAR'S COMPUTATIONS[2]—Continued

Year of birth	Sex	1966	1967	1968	1969	1970	1971	1972	Total
1907	Male	529	517	482	426	399	333	206	8,117
	Female	263	256	254	223	184	161	118	3,806
	Total	792	773	736	649	583	494	324	11,923
1917	Male	705	738	728	715	679	644	577	11,473
	Female	349	334	341	355	349	335	313	5,052
	Total	1,054	1,072	1,069	1,070	1,028	979	890	16,525
1927	Male	832	842	820	824	817	783	697	12,921
	Female	292	320	318	341	349	358	350	4,369
	Total	1,124	1,162	1,138	1,165	1,166	1,141	1,047	17,290
1937	Male	763	796	787	794	769	782	698	10,782
	Female	214	217	227	230	236	243	245	3,443
	Total	977	1,013	1,014	1,024	1,005	1,025	943	14,225
	Total	3,947	4,020	3,957	3,908	3,782	3,639	3,204	59,963

[1] Data are from the 0.1 percent CWHS. For each pair of years, workers with zero earnings in either year are omitted. Workers whose earnings increased more than 50 percent or decreased more than 33 percent are also omitted. Earnings in year of death or disability are set to zero. Workers with AME < $76 are also omitted.

[2] The number of workers entering the computation of the average rate of earnings change ending in the indicated year is recorded.

TABLE 2[1]—AVERAGE ANNUAL RATE OF EARNINGS CHANGE

[Expressed as percentages]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965
1907	Male	4.2	1.5	5.5	3.5	2.7	2.6	3.4	3.7	4.5
	Female	5.2	4.3	6.5	2.5	3.3	5.1	4.0	6.2	3.8
	Total	4.5	2.4	5.8	3.2	2.9	3.4	3.6	4.6	4.3
1917	Male	5.8	1.5	6.6	3.2	2.7	4.4	3.4	4.8	4.3
	Female	5.8	5.8	7.0	4.0	5.7	6.2	4.5	5.1	5.9
	Total	5.8	2.6	6.7	3.4	3.6	4.9	3.8	4.9	4.8
1927	Male	6.9	4.6	8.0	5.9	3.2	6.5	4.7	6.2	6.2
	Female	6.2	5.1	4.6	4.1	4.5	5.7	5.8	6.4	5.1
	Total	6.8	4.7	7.3	5.5	3.4	6.3	5.0	6.2	5.9
1937	Male	10.4	9.6	11.1	8.5	8.5	10.3	8.7	9.7	8.2
	Female	11.2	6.9	7.6	6.7	4.9	5.9	4.8	5.6	4.7
	Total	10.7	8.8	10.1	8.1	7.6	9.2	7.8	8.4	7.5
	Total	6.4	4.5	7.3	4.9	4.3	5.9	5.0	6.0	5.7

TABLE 2[1]—AVERAGE ANNUAL RATE OF EARNINGS CHANGE—Continued

Year of birth	Sex	1966	1967	1968	1969	1970	1971	1972	Total
1907	Male	6.7	3.3	5.0	5.4	3.4	3.0	2.9	3.9
	Female	4.8	5.4	5.0	4.7	5.6	1.5	.5	4.4
	Total	6.0	4.0	5.0	5.2	4.1	2.5	1.7	4.0
1917	Male	7.2	3.8	6.7	5.2	4.8	5.0	6.3	4.7
	Female	5.6	6.1	8.0	7.0	6.7	5.0	5.5	5.9
	Total	6.6	4.5	7.1	5.8	5.4	5.0	6.0	5.0
1927	Male	8.6	4.9	8.4	6.7	4.7	5.6	8.0	6.2
	Female	7.8	7.5	8.5	8.8	8.1	7.5	5.6	6.6
	Total	8.4	5.6	8.4	7.3	5.7	6.2	7.7	6.3
1937	Male	11.0	6.7	9.6	8.1	7.2	7.2	9.1	8.8
	Female	5.7	6.6	10.2	8.7	6.3	8.6	7.0	7.0
	Total	9.8	6.7	9.7	8.2	7.0	7.5	8.5	8.4
	Total	7.8	5.3	7.8	6.8	5.7	5.8	6.7	6.0

[1] Data are from the 0.1 percent CWHS. For each pair of years, workers with zero earnings in either year are omitted. Workers whose earnings increased more than 50 percent or decreased more than 33 percent are also omitted. Earnings in year of death or disability are set to zero. Workers with AME < $76 are also omitted.

TABLE 3[1]—STANDARD DEVIATIONS OF RATES OF CHANGE IN EARNINGS

[Expressed as percentages]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965
1907	Male	15.9	14.3	16.1	14.6	14.1	13.4	13.0	14.7	14.1
	Female	15.0	14.4	13.3	13.7	13.3	13.7	14.5	13.5	12.9
	Total	15.7	14.4	15.3	14.4	13.9	13.6	13.5	14.4	13.7
1917	Male	15.3	14.7	16.2	15.4	15.0	15.1	13.7	14.8	14.3
	Female	15.4	15.3	15.0	14.5	14.3	14.4	13.7	13.3	14.3
	Total	15.3	15.0	15.9	15.1	14.9	14.9	13.7	14.3	14.3
1927	Male	15.8	15.5	16.2	15.6	15.4	15.5	14.7	15.5	15.3
	Female	16.2	15.5	16.2	15.6	16.0	15.9	15.1	14.9	14.3
	Total	15.9	15.5	16.2	15.6	15.5	15.6	14.8	15.4	15.1
1937	Male	19.5	19.0	19.7	19.1	18.2	16.7	16.6	17.1	17.1
	Female	19.0	16.4	16.8	15.8	16.6	16.5	16.1	16.1	16.7
	Total	19.3	18.4	19.0	18.3	17.9	16.7	16.6	17.0	17.1
	Total	16.3	16.0	16.6	15.9	15.7	15.4	14.8	15.4	15.2

TABLE 3.- STANDARD DEVIATIONS OF RATES OF CHANGE IN EARNINGS Continued

Year of birth and sex	1966	1967	1968	1969	1970	71	1972	Total
1907 Male	16 0	15.2	15.2	14 5	14 9	.5 6	17 6	14 9
Female	13 7	15 2	13 4	14.7	16 2	13 7	16 3	14 2
Total	15 3	15 3	14 6	14 5	15 4	15 0	17 2	14 7
1917 Male	15 9	14 4	15 3	15 1	14 4	15 3	14 9	15 1
Female	14 9	14 1	14 5	14 5	14 5	13 6	14 1	14 4
Total	15 6	14 4	15 1	14 9	14 5	14 7	14 6	14 9
1927 Male	16 3	15 2	15 8	15 3	15 3	15 5	16 2	15 6
Female	16 1	15 4	15 2	16 8	15 3	14 6	15 8	15 6
Total	16 2	15 3	15 6	15 8	15 4	15 3	16 1	15.6
1937 Male	16 4	15 1	15 6	15 6	16 3	15 8	15 3	16 9
Female	17 5	17 7	17 4	17 0	16 4	14 9	15 3	16 7
Total	16 8	15 7	16 0	15 9	16 3	15 6	15 4	16.9
Total	16 1	15 2	15 5	15 5	15 4	15 8	15 7	15 6

Data are from the 0.1 percent CWHS. For each pair of years, workers with zero earnings in either year are omitted. Workers whose earnings increased more than by percent or decreased more than 33 percent are also omitted. Earnings in year of death or disability are set to zero. Workers with AME < $[illegible] are also omitted.

Tables 4 through 14 provide data on annual rates of wage change for workers who remain essentially within the same broad earnings level class. The objective is to understand the age pattern of earnings changes within low, middle, and high earnings groups. The data once again is the estimated total earnings for the 1907, 1917, 1927, and 1937 year of birth cohorts represented within the 0.1 percent CWHS. Only workers who remain in the same earnings class (lowest third, middle third, highest third) for 14 of the 17 years from 1956 through 1972 are included. For reasons spelled out before, workers with low AME's are excluded. For each pair of years, the analysis omits workers with zero earnings in either year and those with earnings that increased more than 50 percent or decreased more than 33 percent. Earnings in the year of death or disability are set to zero.

Tables 4 and 5 define the estimated annual earnings, for each year, sex, and year of birth cohort group, that divide the workers into equal groups of low, middle, and high earners. Table 6 provided a count of the workers not excluded and entering the computation for low earnings workers. Table 7 contains annual rates of earnings change within the low earnings groups and table 8 lists the standard deviation of rates of earnings change. Tables 9, 10, and 11 follow the same pattern in reporting information for workers persistently in the middle earnings groups. Tables 12, 13, 14 provide information, organized in the same fashion, for those persistently in the upper third of earnings groups.

Certain observations may be made with respect to these tables:

(1) Tables 4 and 5 indicate that, as would be expected, the distribution of estimated earnings for men is to the right of that for women.

(2) From tables 7, 10, and 13 it appears as if workers persistently in the high earnings classes have a higher average rate of earnings increase than those persistently in the low earnings or middle earnings groups. It also appears as if younger workers (1937 cohort) tend to have larger rates of increase than older workers.

(3) From tables 8, 11, and 14 it appears as if workers persistently in the high earnings groups have greater variability in their rates of earnings change than workers in the middle or high earnings groups.

The analysis of rates of change within the groups of workers persistently in the lower third of the distributions of earnings is complicated by the exclusion of years in which zero earnings are recorded. In order to isolate this problem, these annual earnings data were also analyzed by dividing year of birth and sex groups into five equal earnings groups for each calendar year 1956–1972. In this analysis it was found that those persistently in the lowest quintile group had greater variability (as measured by the standard deviation of the rates of earnings change) and the lowest average rate of earnings increase among the five groups.

TABLE 4[1]- AVERAGE ANNUAL EARNINGS BY AGE SEX COHORT OF WORKERS WHO CONSISTENTLY REMAINED IN THE LOWEST THIRD OF INCOME DISTRIBUTION

Year of earnings	Year of birth and sex: 1907, male	1907, female	1907, total	1917, male	1917, female	1917, total
1956	$3,370	$1,788	$2,599	$3,725	$1,579	$2,808
1957	3,563	2,008	2,803	3,849	1,684	2,905
1958	3,484	1,987	2,703	3,790	1,842	2,928
1959	3,624	2,084	2,873	4,126	1,949	3,105
1960	3,702	2,146	2,827	4,096	2,054	3,101
1961	3,449	2,226	2,782	4,099	2,719	3,241
1962	3,757	2,147	2,984	4,369	2,419	3,366
1963	3,861	2,307	3,075	4,369	2,333	3,380
1964	4,118	2,525	3,298	4,625	2,499	3,599
1965	4,151	2,573	3,341	4,686	2,544	3,759
1966	4,359	2,650	3,453	5,296	2,785	3,974
1967	4,436	2,937	3,587	5,477	3,025	4,225
1968	4,676	2,964	3,761	5,884	3,294	4,473
1969	4,962	2,856	3,865	6,205	3,693	4,858
1970	4,486	2,195	3,674	6,366	3,909	5,027
1971	4,441	2,159	3,626	6,726	4,092	5,266
1972	2,788	1,758	2,272	7,117	4,234	5,425
Total	3,850	2,252	3,086	4,618	2,538	3,720

TABLE 4[1]- AVERAGE ANNUAL EARNINGS BY AGE-SEX COHORT OF WORKERS WHO CONSISTENTLY REMAINED IN THE LOWEST THIRD OF INCOME DISTRIBUTION Continued

Year of earnings	Year of birth and sex: 1927, male	1927, female	1927, total	1937, male	1937, female	1937, total	Total
1956	$3,440	$1,163	$2,713	$899	$762	$714	$2,034
1957	3,487	1,278	2,812	1,132	993	1,115	2,134
1958	3,608	1,405	2,889	1,283	1,263	1,274	2,285
1959	3,838	1,344	3,038	1,610	1,572	1,598	2,512
1960	3,926	1,449	3,093	1,956	1,890	1,937	2,688
1961	3,999	1,594	3,180	2,114	1,932	2,088	2,770
1962	4,515	1,674	3,952	2,680	1,995	2,363	2,996
1963	4,670	1,982	3,573	3,013	1,885	2,761	3,193
1964	4,905	2,057	3,739	3,643	2,137	3,171	3,420
1965	5,161	2,267	3,988	4,138	2,350	3,586	3,681
1966	5,727	2,395	4,342	4,811	2,173	3,900	3,927
1967	6,169	2,800	4,933	5,294	2,451	4,280	4,186
1968	6,748	3,151	4,917	5,348	3,109	4,745	4,481
1969	7,418	3,611	5,389	6,048	3,380	5,202	4,881
1970	7,451	3,656	5,477	6,664	3,435	5,588	5,189
1971	7,759	3,974	5,630	7,223	3,891	5,918	5,410
1972	8,075	4,086	6,123	7,686	4,278	6,301	5,490
Total	4,790	2,216	3,853	2,993	2,054	2,655	3,386

[1] Data is from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent. In year of death or disability, earnings are set to zero, workers with AME ≤ $76 are excluded.

TABLE 5[1] AVERAGE ANNUAL EARNINGS BY AGE SEX COHORT OF WORKERS WHO CONSISTENTLY REMAINED IN THE MIDDLE THIRD OF INCOME DISTRIBUTION

Year of earnings	1907, male	1907, female	1907, total	1917, male	1917, female	1917, total
1956	$5,285	$2,965	$4,594	$5,550	$2,887	$4,878
1957	5,484	3,150	4,827	5,971	3,046	5,235
1958	5,531	3,296	4,861	5,789	3,202	5,090
1959	5,858	3,473	5,096	6,157	3,488	5,514
1960	6,307	3,412	5,330	6,458	3,524	5,642
1961	6,131	3,606	5,332	6,618	3,803	5,743
1962	6,448	3,730	5,551	7,053	3,881	6,042
1963	6,716	4,977	5,868	7,287	3,905	6,200
1964	6,841	4,212	6,060	7,612	4,181	6,510
1965	7,125	4,299	6,137	7,897	4,351	6,675
1966	7,502	4,390	6,649	8,516	4,505	7,203
1967	7,674	4,726	6,661	8,756	4,863	7,439
1968	8,167	4,910	7,150	9,307	5,124	7,904
1969	8,344	5,120	7,321	9,882	5,405	8,338
1970	8,838	5,548	7,826	10,160	5,830	8,662
1971	8,919	5,775	7,915	10,759	6,264	9,119
1972	7,508	5,351	6,874	11,570	6,367	9,823
Total	6,758	4,073	5,879	7,806	4,351	6,709

TABLE 5.1—AVERAGE ANNUAL EARNINGS BY AGE-SEX COHORT OF WORKERS WHO CONSISTENTLY REMAINED IN THE MIDDLE THIRD OF INCOME DISTRIBUTION—Continued

Year of earnings	1927, male	1927, female	1927, total	1937, male	1937, female	1937, total	Total
1956	$5,093	$2,768	$4,624	$1,856	$1,888	$1,866	$4,256
1957	5,312	2,993	4,891	2,079	2,384	2,188	4,378
1958	5,547	3,115	4,967	2,469	2,676	2,572	4,445
1959	5,781	3,097	5,345	3,303	3,030	3,194	4,806
1960	6,287	3,106	5,581	3,912	3,323	3,726	4,969
1961	6,434	3,176	5,732	4,294	3,501	4,047	5,132
1962	6,963	3,378	6,154	4,782	3,693	4,412	5,477
1963	7,387	3,551	6,530	5,182	3,862	4,828	5,783
1964	7,834	3,588	6,869	5,912	4,026	5,414	6,206
1965	8,197	3,860	7,276	6,516	4,125	5,903	6,525
1966	8,941	4,177	7,648	7,221	4,223	6,710	6,998
1967	9,340	4,599	8,061	7,736	4,563	7,107	7,354
1968	10,082	4,809	8,883	8,463	5,067	7,874	7,974
1969	10,905	5,176	9,388	9,395	5,584	8,494	8,481
1970	11,545	5,571	9,764	10,118	5,767	9,102	8,956
1971	12,164	5,920	10,297	11,017	6,258	9,917	9,542
1972	13,122	6,352	10,962	11,835	6,521	10,597	10,045
Total	8,020	4,171	7,034	6,418	3,998	5,649	6,392

[1] Data is from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent in year of death or disability, earnings set to zero, workers with AME ≤ $76 are excluded.

TABLE 6.1—NUMBER OF WORKERS IN THE LOWEST THIRD OF WAGE DISTRIBUTION IN 14 OF 17 YEARS, WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR OF EARNINGS[2]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907	Male	128	110	110	106	107	101	107	96	97	94
	Female	43	34	41	40	42	48	43	42	38	41
	Total	171	144	151	146	149	149	150	138	135	135
1917	Male	138	143	141	133	141	142	127	132	141	129
	Female	34	33	28	38	41	47	51	44	55	62
	Total	172	176	169	171	182	189	178	176	196	191
1927	Male	113	132	136	133	132	138	154	142	151	149
	Female	23	20	16	17	18	24	36	24	25	27
	Total	136	152	152	150	150	162	190	166	176	176
1937	Male	19	49	49	54	56	49	66	66	82	84
	Female	11	10	9	9	9	16	11	11	15	19
	Total	30	59	58	63	65	65	77	77	97	103
Total		509	531	530	530	546	565	595	557	604	605

TABLE 6.1—NUMBER OF WORKERS IN THE LOWEST THIRD OF WAGE DISTRIBUTION IN 14 OF 17 YEARS, WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR OF EARNINGS[2]—Continued

Year of birth	Sex	1967	1968	1969	1970	1971	1972	Total
1907	Male	82	76	65	68	52	32	1,431
	Female	39	44	35	29	27	21	607
	Total	121	120	100	97	79	53	2,038
1917	Male	136	138	134	128	120	94	2,117
	Female	56	63	70	72	70	70	834
	Total	192	201	204	200	190	164	2,951
1927	Male	154	137	142	135	122	116	2,186
	Female	43	43	52	65	65	70	568
	Total	197	180	194	200	187	186	2,754
1937	Male	97	92	99	88	104	91	1,145
	Female	21	32	32	30	32	42	309
	Total	118	124	131	118	136	133	1,454
Total		628	625	629	615	592	536	9,197

[1] Data is from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent in year of death or disability, earnings are set to zero, workers with AME ≤ $76 are excluded.

[2] Year is the calendar year at end of the period over which change is measured.

TABLE 7.[1]—AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE LOWEST THIRD OF WAGE DISTRIBUTION

[Expressed as percentages]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907	Male	3.3	0.6	7.3	3.5	−1.0	3.3	3.7	5.1	8.0	6.5
	Female	3.3	1.1	8.3	2.4	−.2	10.6	5.1	6.8	−1.0	5.9
	Total	3.3	.8	7.6	3.2	−.8	5.6	4.1	5.6	5.4	6.3
1917	Male	2.0	3.0	1.5	1.0	2.8	3.2	.7	3.7	6.5	4.3
	Female	−1.1	11.0	2.9	6.0	8.8	10.0	4.6	1.8	9.1	8.9
	Total	1.4	4.5	1.7	2.1	4.2	4.9	1.9	3.2	7.2	5.8
1927	Male	3.5	5.8	8.6	6.5	3.5	4.9	3.3	6.4	8.7	9.0
	Female	5.0	14.5	1.3	−.5	2.6	2.7	4.4	6.7	−2.1	17.4
	Total	3.8	7.8	7.8	5.7	3.4	4.6	3.5	6.4	7.2	10.3
1937	Male	9.1	8.3	10.4	11.0	10.7	6.9	8.7	7.2	7.8	9.7
	Female	−2.7	.8	−3.6	15.4	10.6	6.7	−.2	2.2	7.4	1.5
	Total	4.7	7.1	8.2	11.6	10.7	6.9	7.5	6.5	7.8	8.2
	Total	2.9	4.5	5.9	4.6	3.4	5.2	3.7	5.2	6.9	7.6

TABLE 7.[1] AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE LOWEST THIRD OF WAGE DISTRIBUTION Continued

Year of birth	Sex	1967	1968	1969	1970	1971	1972	Total
1907	Male	4.7	10.4	4.0	−2.0	2.9	3.5	4.0
	Female	5.7	.4	1.8	7.5	−2.5	1.2	3.8
	Total	5.0	6.7	3.2	.9	1.1	2.6	3.9
1917	Male	5.7	6.6	5.3	4.3	5.2	5.1	3.8
	Female	9.2	8.8	7.8	9.6	6.7	1.8	6.9
	Total	6.7	7.3	6.1	6.2	5.8	3.7	4.6
1927	Male	3.4	8.3	7.0	4.9	6.3	5.3	6.0
	Female	8.3	6.3	4.6	9.9	6.7	5.9	6.4
	Total	4.5	7.8	6.3	6.6	6.4	5.5	6.1
1937	Male	8.7	8.0	9.4	8.6	6.4	8.0	8.5
	Female	9.8	9.9	9.5	11.1	13.2	6.6	7.1
	Total	8.0	8.5	9.4	9.3	8.0	7.6	8.2
	Total	5.9	7.6	6.4	6.1	5.9	5.2	5.5

[1] Rates for workers counted in table 6

TABLE 8.[1] STANDARD DEVIATIONS OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE LOWEST THIRD OF WAGE DISTRIBUTION

[Expressed as percentages]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907	Male	18.1	17.1	18.6	17.7	15.1	14.7	16.9	17.1	16.9	18.8
	Female	16.8	22.5	13.7	15.5	15.2	16.0	21.2	19.6	15.2	17.0
	Total	17.8	18.5	17.4	17.1	15.2	15.5	18.3	17.9	16.9	18.3
1917	Male	15.6	16.6	17.5	17.1	16.4	17.3	15.7	17.1	17.4	15.6
	Female	17.9	21.8	19.3	19.8	20.5	18.2	17.5	15.9	16.5	19.0
	Total	16.1	18.0	17.8	17.8	17.6	17.8	16.3	16.9	17.2	16.9
1927	Male	18.8	15.6	16.5	17.1	17.2	16.7	16.0	16.9	16.4	15.9
	Female	14.4	18.9	19.1	17.4	20.0	18.8	20.0	20.7	20.0	18.5
	Total	18.1	16.3	16.9	17.3	17.5	17.0	16.8	17.5	17.4	16.6
1937	Male	25.3	18.8	21.0	22.1	21.2	15.3	18.1	20.6	20.5	15.4
	Female	19.2	20.8	24.1	12.9	23.5	16.6	13.8	22.9	19.4	19.3
	Total	22.9	19.3	22.1	21.1	21.5	15.7	17.8	20.9	20.4	16.5
	Total	17.8	18.0	18.2	18.1	17.8	16.8	17.3	18.0	17.8	17.2

TABLE 8.[1] STANDARD DEVIATIONS OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE LOWEST THIRD OF WAGE DISTRIBUTION Continued

Year of birth	Sex	1967	1968	1969	1970	1971	1972	Total
1907	Male	18.0	15.3	16.6	17.4	17.6	16.8	17.4
	Female	20.2	18.7	17.9	22.8	15.7	19.2	18.4
	Total	18.7	17.3	17.1	19.6	17.2	17.8	17.7
1917	Male	17.1	16.6	18.2	14.9	16.9	17.7	16.8
	Female	15.5	15.6	16.5	17.0	16.2	15.1	17.7
	Total	16.7	16.3	17.7	15.9	16.7	16.7	17.1
1927	Male	15.7	17.3	18.4	18.9	17.7	17.2	17.1
	Female	19.9	17.8	19.3	18.7	16.9	16.0	18.8
	Total	16.9	17.4	18.7	18.9	17.4	16.7	17.5
1937	Male	17.5	16.6	17.3	18.5	16.1	15.7	18.3
	Female	23.4	19.8	19.6	20.4	14.0	16.5	19.6
	Total	18.7	17.5	17.9	19.1	15.8	16.0	18.6
	Total	17.6	17.1	18.0	18.3	16.9	16.7	17.6

[1] Data are from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent. In year of death or disability, earnings are set to zero; workers with AIME ≤$76 are excluded.

TABLE 9.[1]—NUMBER OF WORKERS IN THE MIDDLE THIRD OF WAGE DISTRIBUTION IN 14 OF 17 YEARS WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR[2] OF EARNINGS

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907	Male	55	54	54	55	56	57	56	55	56	56
	Female	23	23	23	23	23	23	23	23	23	22
	Total	78	77	77	78	79	80	79	78	79	78
1917	Male	103	103	100	103	106	103	102	102	98	102
	Female	19	23	24	24	24	24	24	23	22	24
	Total	122	126	124	127	130	127	126	125	120	126
1927	Male	100	100	106	105	108	107	107	106	108	108
	Female	9	10	10	8	9	10	11	11	11	11
	Total	109	110	116	113	117	117	118	117	119	120
1937	Male	7	13	13	17	15	15	18	19	18	17
	Female	3	9	7	8	9	9	10	10	10	9
	Total	10	22	20	25	24	24	28	29	28	26
	Total	319	335	337	343	350	348	351	349	346	350

TABLE 9.[1] NUMBER OF WORKERS IN THE MIDDLE THIRD OF WAGE DISTRIBUTION IN 14 OF 17 YEARS WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR[2] OF EARNINGS—Continued

Year of birth	Sex	1967	1968	1969	1970	1971	1972	Total
1907	Male	57	57	55	46	40	21	830
	Female	22	24	24	21	20	16	356
	Total	79	81	79	67	60	37	1,185
1917	Male	105	104	104	102	100	98	1,635
	Female	24	23	24	24	24	22	372
	Total	129	127	128	126	124	120	2,007
1927	Male	108	109	108	106	103	102	1,692
	Female	11	9	10	9	10	11	160
	Total	119	118	118	115	113	113	1,852
1937	Male	19	19	19	18	19	19	265
	Female	9	10	9	10	10	10	142
	Total	28	29	28	28	29	29	407
	Total	365	355	353	336	326	299	5,452

[1] Data are from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent in year of death or disability, earnings are set to zero, workers with AME < $76 are excluded.

[2] Year is the calendar year at the end of the period over which change is measured.

TABLE 10.[1]—AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE MIDDLE THIRD OF WAGE DISTRIBUTION

[Expressed as percentages]

Year of birth	Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907	Male	7.2	1.0	5.3	4.1	2.1	1.7	3.1	3.2	5.8	8.4
	Female	2.6	2.9	7.4	−3.4	6.3	5.3	3.3	6.3	5.5	2.3
	Total	5.8	1.6	5.9	1.9	3.4	2.7	3.2	4.1	5.7	6.7
1917	Male	6.4	.3	7.4	3.0	.9	4.1	3.9	3.2	4.4	6.1
	Female	7.6	5.1	7.2	3.3	6.5	7.2	2.8	4.1	5.0	4.6
	Total	6.6	1.2	7.4	3.9	2.0	4.7	3.7	3.3	4.5	5.8
1927	Male	5.8	3.1	8.8	6.1	1.9	6.8	5.0	6.6	4.9	10.4
	Female	8.2	7.1	5.6	4.9	7.1	2.8	4.8	9.6	4.5	6.4
	Total	6.0	3.4	8.5	6.0	2.3	6.5	5.0	6.9	4.8	10.0
1937	Male	5.9	6.1	21.2	6.6	9.4	12.4	13.3	6.6	9.6	11.9
	Female	−5.3	−3.4	15.1	5.4	9.6	5.1	2.2	5.4	3.9	6.7
	Total	2.5	2.2	19.0	6.2	9.5	9.7	9.3	6.2	7.5	10.1
	Total	6.1	2.1	8.1	4.3	2.9	5.2	4.4	4.9	5.2	7.8

TABLE 10.[1] AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE MIDDLE THIRD OF WAGE DISTRIBUTION—Continued

Year of birth	Sex	1967	1968	1969	1970	1971	1972	Total
1907	Male	0	5.5	4.9	6.3	−0.7	1.0	3.8
	Female	3.5	8.6	5.2	6.4	2.6	1	4.2
	Total	1.0	6.4	5.0	6.3	.4	.6	3.9
1917	Male	3.5	6.5	5.9	5.2	5.7	6.4	4.6
	Female	3.5	8.4	8.8	4.7	4.0	3.1	5.3
	Total	3.5	6.8	6.3	5.1	5.4	5.8	4.2
1927	Male	3.8	8.0	7.9	4.3	6.2	8.0	6.1
	Female	10.4	14.0	6.4	3.0	8.7	3.0	6.6
	Total	4.4	8.4	7.8	4.2	6.1	7.5	6.2
1937	Male	10.8	7.4	9.8	6.1	12.1	9.3	9.9
	Female	6.9	9.0	7.6	6.0	2.9	5.5	5.4
	Total	9.5	7.9	9.1	6.1	8.9	8.0	8.3
	Total	3.7	7.3	6.7	5.1	5.2	6.0	5.3

[1] Data are from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent in year of death or disability, earnings are set to zero, workers with AME ≤ $76 are excluded.

TABLE 11.[1]—STANDARD DEVIATIONS OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE MIDDLE THIRD OF WAGE DISTRIBUTION

[Expressed as percentages]

Year of birth: Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907: Male	12.7	8.7	10.3	10.7	7.2	8.5	10.3	8 4	10.2	11.4
Female	13.8	7.8	9.9	9.5	12.7	8.5	12.0	10.0	8.5	12.3
Total	13.2	8.5	10 2	10.9	9.4	8.7	10.8	9.0	9.8	12.0
1917: Male	11.9	11.7	11.8	9 0	9.5	9.3	11.5	10.0	10.3	12.7
Female	14.8	11.2	12.3	13.6	8.9	10.2	7.6	11.0	7.0	5.0
Total	12.4	11.8	11.9	10.1	9.7	9.5	10.9	10.2	9.8	11.6
1927: Male	12.5	13.0	13.7	14 3	12 0	13.2	12.0	15.0	13 9	14.5
Female	14.2	8.4	8.9	5 6	12.5	17.1	11 5	14.0	3.5	10.5
Total	12.6	12 8	13.3	13.9	12.2	13.6	12.0	14.9	13.3	14.2
1937: Male	20.8	19.6	20 8	18.2	17.8	16.2	12.7	7.1	9.2	13.3
Female	24.2	13.7	13.2	4.9	10.7	2.3	6.9	10.7	7 2	6.1
Total	22.5	18.0	18.7	15.3	15.5	13.3	12.2	8.5	8.9	11.6
Total	13.1	12.0	12.9	12.2	11.1	11.3	11.5	11.8	11 1	12.8

TABLE 11.[1]- STANDARD DEVIATIONS OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE MIDDLE THIRD OF WAGE DISTRIBUTION—Continued

Year of birth. Sex	1967	1968	1969	1970	1971	1972	Total
1907 Male	9 9	9.7	10.7	11.1	16 6	18 6	11.1
Female	10.9	8 0	11.5	9.3	12.0	15 6	11 2
Total	10.3	9.4	10 9	10 6	15.3	17 4	11 1
1917. Male	10.0	11.1	10.0	11.0	11.7	11.0	11.0
Female	9 4	12.1	10.1	10.1	9 5	10.1	10.6
Total	9.9	11 3	10.1	10.8	11.3	10.9	10.9
1927. Male	10.0	9.6	8 8	11.1	12.1	10.6	12.6
Female	11 8	11 5	9 5	13.5	6 4	13.1	11.7
Total	10.3	9.9	8.9	11 3	11.7	11.0	12 5
1937 Male	14.1	9.7	11.7	9.9	11.9	14 4	14 5
Female	11.6	13 6	6 1	5.9	7.1	12.5	10.8
Total	13.4	11 2	10 3	8.7	11.4	13.9	13.5
Total	10.7	10.4	10.0	10.8	12.5	12.4	11.8

[1] Data are from the 0 1 percent CWHS Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent In year of death or disability, earnings are set to zero, workers with AME ≤$76 are excluded

TABLE 12[1]- NUMBER OF WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF WAGE DISTRIBUTION BY YEAR WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR OF EARNINGS[2]

Year of birth Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907 Male	82	85	85	84	86	88	84	81	84	88
Female	42	44	47	49	49	49	48	48	47	46
Total	124	129	132	133	135	137	132	129	131	134
1917 Male	135	137	139	138	143	146	141	145	136	134
Female	42	43	45	51	53	54	52	53	52	53
Total	177	180	184	189	196	200	193	198	188	187
1927 Male	125	124	124	125	125	129	125	124	120	120
Female	39	39	40	44	44	44	44	44	44	43
Total	164	163	164	169	169	173	169	168	164	163
1937 Male	27	34	37	38	38	39	42	41	42	41
Female	6	5	5	10	10	10	10	9	9	10
Total	33	39	42	48	48	49	52	50	51	51
Total	498	511	522	539	548	559	546	545	534	535

TABLE 12[1]- NUMBER OF WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF WAGE DISTRIBUTION BY YEAR WITHIN YEAR OF BIRTH AND SEX GROUPS BY YEAR OF EARNINGS[2]—Continued

Year of birth Sex	1967	1968	1969	1970	1971	1972	Total
1907 Male	84	86	81	78	67	41	1,284
Female	50	48	47	42	36	26	718
Total	134	134	128	120	103	67	2,002
1917 Male	143	143	145	125	125	120	2,195
Female	53	51	52	52	49	47	802
Total	196	194	197	177	174	167	2,997
1927 Male	118	122	120	121	116	109	1,947
Female	43	43	44	44	43	42	684
Total	161	165	164	165	159	151	2,631
1937 Male	42	40	39	40	41	40	621
Female	10	10	10	10	9	9	142
Total	52	50	49	50	50	49	763
Total	543	543	538	512	486	434	8,393

[1] Data are from the 0 1 percent CWHS Workers with zero earnings are excluded, as are workers whose earnings increased by more than 50 percent or decreased more than 33 percent In year of death or disability, earnings are set to zero, workers with AME ≤$76 are excluded

[2] Year is the calendar year at the end of the period over which change is measured.

TABLE 13.[1]—AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF EARNINGS

[Expressed as percentages]

Year of birth, Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907 Male	3.4	2.4	7.8	3.0	5.6	0.6	2.5	0.7	2.6	6.2
Female	6.1	6.8	7.5	1.1	5.7	5.2	3.1	6.9	2.8	5.7
Total	4.3	3.9	7.7	2.3	5.6	2.3	2.7	3.0	2.7	6.0
1917 Male	6.6	2.5	9.8	3.5	4.5	2.6	2.0	4.5	3.3	9.8
Female	9.1	2.6	10.4	3.6	5.5	5.7	4.7	4.4	4.5	6.6
Total	7.2	2.5	9.3	3.5	4.8	3.4	2.7	4.5	3.6	8.9
1927 Male	11.3	6.4	9.2	6.7	6.3	6.0	8.3	4.2	3.3	8.8
Female	8.6	4.3	9.2	6.6	3.4	6.0	7.2	4.4	5.7	5.3
Total	10.7	5.9	9.2	6.7	5.6	6.0	8.0	4.3	4.0	7.8
1937 Male	15.7	12.4	13.3	14.8	2.9	9.6	13.0	6.8	8.4	13.2
Female	7.2	15.8	20.4	7.9	8.9	4.5	4.2	10.0	5.4	12.2
Total	14.2	12.9	14.1	13.4	4.1	8.5	11.3	7.3	7.9	13.0
Total	8.1	4.7	9.3	5.1	5.2	4.4	5.2	4.3	3.9	8.3

TABLE 13.[1] AVERAGE ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF EARNINGS - Continued

Year of birth, Sex	1967	1968	1969	1970	1971	1972	Total
1907 Male	6.6	5.9	6.2	1.8	2.3	4.9	3.9
Female	6.3	6.7	5.4	4.8	3.2	.3	5.0
Total	6.5	6.2	5.9	2.9	2.6	3.1	4.3
1917 Male	3.2	7.9	6.2	3.9	6.2	8.5	5.2
Female	5.2	4.5	8.3	7.9	3.6	6.4	5.8
Total	3.8	7.0	6.7	5.1	5.5	7.9	5.4
1927 Male	7.2	7.5	4.8	6.6	3.6	9.0	6.8
Female	6.7	6.7	4.3	9.3	8.1	6.0	6.4
Total	7.1	7.3	4.7	7.3	4.8	8.1	6.7
1937 Male	1.0	10.1	10.9	5.5	10.8	10.4	9.7
Female	2.6	16.1	3.3	5.7	.4	4.7	7.5
Total	1.3	11.3	9.3	5.6	9.0	9.3	9.3
Total	5.7	7.3	6.2	5.3	5.0	7.4	5.9

[1] Data are from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent. In year of death or disability, earnings are set to zero, workers with AME ≤$76 are excluded.

TABLE 14.[1]- STANDARD DEVIATION OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF WAGE DISTRIBUTION

[Expressed as percentages]

Year of birth, Sex	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1907 Male	12.6	11.6	11.2	8.4	11.1	10.1	8.2	10.7	10.4	15.8
Female	9.4	12.3	10.3	9.3	9.0	9.0	10.4	10.1	8.3	11.6
Total	11.7	12.1	10.9	8.8	10.4	10.0	9.0	10.9	9.7	14.5
1917 Male	13.7	13.8	13.3	13.9	13.3	13.3	9.5	12.5	11.9	16.4
Female	15.7	11.4	13.0	10.3	10.8	10.1	10.5	9.3	11.6	13.1
Total	14.2	13.2	13.3	13.0	12.7	12.6	9.9	11.7	11.8	15.6
1927 Male	14.2	15.0	14.9	15.2	13.5	13.2	12.8	11.5	12.7	17.3
Female	13.6	11.8	11.9	12.3	8.7	10.9	9.3	9.1	9.4	9.9
Total	14.1	14.3	14.6	14.5	12.5	12.7	12.0	10.9	12.0	15.8
1937 Male	13.4	16.3	18.0	17.0	14.8	12.9	16.3	17.2	18.9	14.3
Female	16.4	13.7	14.8	12.7	8.2	6.7	6.0	9.6	10.8	14.0
Total	14.4	16.0	17.8	16.4	13.9	12.1	15.3	16.2	17.8	14.2
Total	13.9	13.8	13.7	13.3	12.2	12.1	11.4	11.8	12.2	15.4

TABLE 14.[1]- STANDARD DEVIATION OF ANNUAL RATES OF EARNINGS CHANGE FOR WORKERS PERSISTENTLY IN THE HIGHEST THIRD OF WAGE DISTRIBUTION - Continued

Year of birth, Sex	1967	1968	1969	1970	1971	1972	Total
1907 Male	14.2	14.8	14.8	11.9	11.8	15.4	12.4
Female	10.7	9.8	11.8	11.3	10.4	15.3	10.7
Total	13.0	13.2	13.8	11.8	11.4	15.5	11.8
1917 Male	11.8	14.6	12.5	11.6	12.4	11.6	13.2
Female	10.9	13.5	12.4	13.0	12.1	11.2	12.0
Total	11.6	14.4	12.5	12.2	12.4	11.5	12.9
1927 Male	14.6	14.4	14.2	12.1	12.5	16.8	14.3
Female	8.4	6.7	9.7	12.0	9.3	13.1	10.6
Total	13.2	12.8	13.1	12.2	11.9	15.9	13.5
1937 Male	13.6	14.0	15.2	14.0	11.6	10.8	15.6
Female	6.7	13.9	14.7	18.7	9.2	8.2	12.8
Total	12.6	14.2	15.4	15.1	11.9	10.6	15.1
Total	12.7	13.7	13.4	12.5	12.1	13.9	13.1

[1] Data are from the 0.1 percent CWHS. Workers with zero earnings are excluded, as are workers whose annual earnings increased by more than 50 percent or decreased more than 33 percent. In year of death or disability, earnings are set to zero, workers with AME ≤$76 are excluded.

Section 2. Year of Peak Earnings

The basic objective of this section is to present tabulations of information obtained from the 0.1 percent CWHS concerning the calendar year in which peak estimated earnings were achieved for 1906 and 1907 year of birth cohorts of retired lives. The analysis proceeded along parallel tracks. In the first analysis, estimated total annual earnings for each retired worker are used. The second analysis involves the use of a price adjusted set of estimated total annual earnings for each worker. Workers deceased, disabled, and those with AME <$76 were excluded.

Tables 15 and 16 contain the results for estimated money earnings. The average year of peak earnings is tabulated in table 15 and the standard deviation of the year of peak earnings is presented in table 16. The corresponding results for estimated real earnings, adjusted using the Consumer Price Index (CPI), are presented in tables 17 and 18.

A comparison of these tables leads to several observations:

(1) From comparing tables 15 and 17 it is clear that the impact of making a price adjustment is to shift the distribution of calendar years in which peak earnings are achieved significantly to the left.

(2) Tables 16 and 18 support the proposition that there is considerable dispersion in the distribution of the calendar year of the attainment of maximum earnings.

SEC. 2—YEAR OF PEAK EARNINGS

TABLE 15[1] AVERAGE YEAR OF PEAK EARNINGS AND NUMBER OF RETIRED WORKERS, BY SEX, YEAR OF RETIREMENT AND YEAR OF BIRTH

	Average peak year			Number of workers		
	Birth year			Birth year		
Sex: Year of retirement	1906	1907	Total	1906	1907	Total
Male						
1968	1963.7	1967.0	1963.7	112	1	113
1969	1967.1	1964.4	1965.2	55	125	180
1970	1966.0	1966.7	1966.3	85	64	149
1971	1968.3	1967.6	1968.1	315	93	408
1972	1966.5	1968.8	1968.7	17	303	320
Total	1966.9	1967.5	1967.2	584	568	1,170
Female						
1968	1963.3		1963.3	119		119
1969	1966.5	1965.0	1965.4	40	116	156
1970	1967.0	1968.1	1967.5	41	30	71
1971	1969.2	1968.0	1968.9	122	38	160
1972	1967.6	1968.8	1968.6	40	167	207
Total	1966.6	1967.4	1967.0	362	751	713
Grand total	1966.8	1967.4	1967.1	946	937	1,883

[1] Data are from the 0.1 percent CWHS with deceased, disabled, and workers with low AME, AME ≤$76, excluded.

TABLE 16[1] -STANDARD DEVIATION OF YEAR OF PEAK EARNINGS

	Birth year		
Sex: Year of retirement	1906	1907	Total
Male			
1968	4.4	0	4.3
1969	2.9	4.2	4.0
1970	4.7	4.2	4.5
1971	4.1	4.2	4.1
1972	5.4	4.1	4.2
Total	4.5	4.5	4.5
Female			
1968	4.0	0	4.0
1969	3.5	4.2	4.1
1970	3.7	3.1	3.5
1971	3.1	3.6	3.3
1972	4.3	4.1	4.1
Total	4.4	4.3	4.4
Grand total	4.5	4.4	4.5

[1] Data are from the 0.1 percent CWHS with deceased, disabled, and workers with low AME, AME ≤ $76, excluded.

TABLE 17.[1]—AVERAGE YEAR OF PEAK EARNINGS INDEXED BY CPI WITHIN SEX, YEAR OF RETIREMENT, AND YEAR OF BIRTH GROUPS

Sex, Year of retirement	Year of birth		Total
	1906	1907	
Male			
1968	1962.7	1962.0	1962.7
1969	1965.4	1963.2	1963.9
1970	1964.4	1964.2	1964.3
1971	1965.8	1965.3	1965.7
1972	1965.5	1966.2	1966.2
Total	1965.0	1965.2	1965.1
Female			
1968	1962.3	0	1962.3
1969	1965.5	1963.7	1964.2
1970	1965.4	1966.5	1965.6
1971	1967.8	1966.4	1967.1
1972	1966.0	1967.1	1966.9
Total	1965.3	1965.9	1965.6
Grand total	1965.1	1965.5	1965.3

[1] Data are from the 0.1 percent CWHS with deceased, disabled, and workers with low AME, AME ≤$76, excluded.

TABLE. 18[1]- STANDARD DEVIATION OF YEAR OF PEAK EARNINGS INDEXED BY CPI

Sex Year of retirement	Year of birth		Total
	1906	1907	
Male			
1968	4.5	0	4.5
1969	3.9	4.4	4.4
1970	4.9	4.9	4.9
1971	4.7	4.7	4.7
1972	5.1	4.8	4.8
Total	4.8	4.9	4.8
Female			
1968	4.1	0	4.1
1969	3.7	4.2	4.2
1970	3.9	3.4	3.7
1971	3.9	4.1	4.0
1972	4.4	4.6	4.6
Total	4.6	4.6	4.6
Grand total	4.7	4.8	4.7

[1] Data are from the 0.1 percent CWHS with deceased, disabled, and workers with low AME, AME ≤ $76, excluded.

Section 3. Number of Declines

The purpose of this section is to examine earnings variability by counting the number of 10 percent declines from one year to the next for a sample of earnings histories. The data analyzed is from the 0.1 percent CWHS, the 1906 and 1907 year of birth cohorts. Data for workers retiring in 1969, 1970, 1971, and 1972 are analyzed. As before, deceased and disabled workers and those with AME<$76 are excluded. To approximate the operation of the current Social Security system, earnings are limited to a hypothetical taxable maximum consistent with the automatic provisions of the present law. It is clear that declines of 10 percent or more are very common.

About 57 percent of the 1906 cohort retiring in 1971 (normal retirement) has 0, 1, or 2 years of 10 percent declines, while of those retiring in 1968, 1969, or 1971, only 27 percent had 0, 1, or 2 years of 10 percent earnings declines. For the members of the 1907 cohort within the sample, 61 percent of those retiring in 1972 (normal retirement) had 0, 1, or 2 years of 10 percent earnings decline. It appears as if those taking early retirement have higher levels of earnings variability, as measured by the frequency of 10 percent earnings declines.

SEC. 3—NUMBER OF DECLINES

TABLE 19.1— NUMBER OF WORKERS WITH 10-PERCENT DECLINES IN ESTIMATED EARNINGS LIMITED BY AUTOMATICALLY ADJUSTED (HYPOTHETICAL) TAXABLE MAXIMUM

Birth year Retirement year	1906 1968	1906 1969	1906 1970	1906 1971	1906 1972	1906 Total	1907 1968	1907 1969
Sex Number of declines								
Male								
0	1			25	3	29		2
1	4	4	6	63	4	81		11
2	19	13	16	86	2	136		18
3	12	9	16	48	1	87		24
4	16	11	13	39	3	82		14
5	23	5	16	22	2	68		24
6	13	9	10	13		45	1	17
7	14	3	5	13	1	36		8
8	7	1	3	4	1	16		6
9	2			1		3		1
10	1					1		
Total	112	55	85	315	17	584	1	125
Female								
0			2	19	5	26		1
1	6	2	3	22	5	38		9
2	27	9	9	34	8	87		24
3	23	11	8	17	2	61		26
4	22	9	7	13	7	58		18
5	21	6	3	10	2	42		18
6	11	2	8	5	7	33		9
7	4		1		4	9		8
8	3	1		2		6		3
9	2					2		0
Total	119	40	41	122		362		116
Grand total	231	95	126	437	57	946	1	241

TABLE 19.1--NUMBER OF WORKERS WITH 10-PERCENT DECLINES IN ESTIMATED EARNINGS LIMITED BY AUTOMATICALLY ADJUSTED (HYPOTHETICAL) TAXABLE MAXIMUM—Continued

Birth year Retirement year	1907 1970	1907 1971	1907 1972	1907 Total	Total Total
Sex Number of declines					
Male					
0	1	4	50	57	86
1	7	10	77	105	186
2	12	20	58	108	244
3	15	20	33	92	179
4	5	19	42	80	162
5	11	7	23	65	133
6	4	9	8	39	84
7	4	3	8	23	59
8	4	1	1	12	28
9	1			2	5
10			3	3	4
Total	64	93	303	586	1,170
Female					
0	1	3	26	31	57
1	3	3	37	52	90
2	10	11	38	83	170
3	4	5	24	59	120
4	5	8	20	51	109
5	2	4	12	36	78
6	2	2	6	19	52
7	2	2	2	14	23
8			2	5	11
9	1			1	3
Total	30	38	167	351	713
Grand total	94	131	470	937	1,883

[1] Data are from the 0.1 percent CWHS with deceased, disabled, and workers with low AME, AME ≤ $76, excluded.

Section 4. High-5

The tables of this section are designed to display some of the characteristics that are relevant to a benefit formula based on workers' five high years of earnings. The data comes from retired lives among the members of the 1906 and 1907 year of birth cohorts represented in the 0.1 percent CWHS. Deceased and disabled workers and those with AME ≤ $76 are excluded. Table 20 displays a tabulation of the year of the earliest of the five years of highest earnings,

limited by an automatically adjusted (hypothetical) maximum consistent with the present law. In table 21, corresponding data is presented for the latest year of the high 5 years of estimated earnings. Probably the most important inference may be drawn from table 20, where it is clear that the earliest year in the high 5 years of earnings occurs several years before retirement for a significant proportion of workers.

SEC 4 HIGH FIVES

TABLE 20.[1] FREQUENCY OF EARLIEST YEARS OF HIGH 5 YEARS OF ESTIMATED EARNINGS LIMITED BY AUTOMATIC ADJUSTED (HYPOTHETICAL) MAXIMUM

	Male						Female					
	Birth year						Birth year					
	1906		1907		Total		1906		1907		Total	
Earliest year	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1956	86	13 2	82	12 6	168	12 9	48	12 5	42	11 1	90	11 8
1957	32	4 9	45	6 9	77	5 9	23	6 0	23	6 1	46	6 8
1958	25	3 8	15	2 3	40	3 1	12	3 1	15	4 0	27	3 5
1959	27	4 1	26	4 0	53	4 1	21	5 5	21	5 6	42	5 5
1960	32	4 9	18	2 8	50	3 8	18	4 7	21	5 6	39	5 1
1961	25	3 8	34	5 2	59	4 5	33	8 6	17	4 5	50	6 6
1962	42	6 4	21	3 2	63	4 8	19	4 9	25	6 6	44	5 8
1963	52	8 0	38	5 8	90	6 9	34	8 8	24	6 3	58	7 6
1964	50	7 7	49	7 5	99	7 6	30	7 8	31	8 2	61	8 0
1965	68	10 4	39	16 0	107	18 2	31	8 1	23	6 1	54	7 1
1966	77	11 8	83	12 7	160	12 3	50	13 0	28	7 4	78	10.2
1967	80	12 3	93	14 3	173	13 3	31	8 1	40	10 6	71	9 3
1968	56	8 6	108	16 6	164	12 6	35	9 1	68	18 0	103	13 5
Total	652	100.9	651	100 0	1 303	100 0	385	100 0	378	100 0	763	100 0

[1] Data are for retired lives from 0 1e CWHS, excluding deceased, disabled, and workers with low AME

TABLE 21.[1] FREQUENCY OF LATEST YEAR OF HIGH 5 YEARS OF ESTIMATED EARNINGS LIMITED BY AUTOMATICALLY ADJUSTED (HYPOTHETICAL) MAXIMUM

	Male						Female					
	Birth year						Birth year					
	1906		1907		Total		1906		1907		Total	
Latest year	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1960	3	0 5	14	2 2	17	1 3	8	2 1	9	2 4	17	2 2
1961	12	1 8	10	1 5	22	1 7	12	3 1	4	1 1	16	2 1
1962	12	1 8	9	1 4	21	1 6	7	1 8	10	2 6	17	2 2
1963	6	9	15	2 3	21	1 6	10	2 6	2	5	12	1 6
1964	11	1 7	16	2 5	27	2 1	7	1 8	6	1 6	13	1.7
1965	18	2 8	21	3 2	39	3 0	21	5 5	12	3 2	33	4 3
1966	30	4 6	20	3 1	50	3 8	21	5 5	18	4.8	39	5 1
1967	52	8 0	21	3 2	73	5 6	42	10 9	24	6 3	66	8 7
1968	66	10 1	50	7.7	116	8 9	40	10 4	49	13 0	89	11 7
1969	72	11 0	68	10 4	140	10 7	34	8 8	49	13 0	83	10 9
1970	117	17 9	76	11 7	193	14 8	56	14.5	31	8 2	87	11 4
1971	147	22 5	142	21 8	289	22 2	52	13 5	47	12 4	99	13 0
1972	106	16 3	189	29 0	295	22 6	75	19 5	117	31 0	192	25 2
Total	652	100 0	651	100 0	1 303	100 0	385	100 0	378	100 0	763	100 0

[1] Data are for retired lives from 0 1e CWHS, excluding deceased, disabled, and workers with low AME.

Section 5. Years at Maximum

Table 22 is derived from the 0.1 percent CWHS. Within a classification system involving year of birth and sex, the number of years that estimated earnings are at or above the adjusted (hypothetical) taxable maximum from 1956 through 1972 are tabulated. As before, deceased and disabled workers are excluded. Several observations may be made:

(1) The majority of workers did not reach the adjusted hypothetical maximum.

(2) Many more men than women exceed the taxable maximum.

(3) Members of the youngest cohort (1937) had not yet reached the taxable maximum in significant numbers.

(4) The oldest cohort (1907) did not reach the maximum with as high a frequency as the 1917 and 1927 cohorts.

SEC. 5—YEARS AT TAXABLE MAXIMUM EARNINGS BASE

TABLE 22.1—NUMBER OF YEARS THAT ESTIMATED EARNINGS ARE AT OR ABOVE THE AUTOMATICALLY ADJUSTED (HYPOTHETICAL) TAXABLE MAXIMUM EARNINGS BASE, 1956-72

Number years	Male					Female					Grand total
	Year of birth				Total	Year of birth				Total	
	1907	1917	1927	1937		1907	1917	1927	1937		
0	550	694	678	741	2,672	920	1,194	1,333	1,243	4,690	7,362
1	30	65	86	85	266	9	10	10	10	39	305
2	33	45	45	67	190	5	2	5	2	14	204
3	15	23	41	62	141	2	7	2	4	15	156
4	18	30	38	48	134	5	0	2	4	11	145
5	15	25	30	42	112	0	2	1	2	5	117
6	17	20	43	48	128	2	0	2	2	6	134
7	12	22	35	33	102	3	3	0	2	8	110
8	15	31	29	39	114	2	4	2	0	8	122
9	12	15	29	26	82	3	1	0	0	4	86
10	13	12	32	17	74	3	2	0	0	5	79
11	8	15	28	10	61	4	1	1	0	6	67
12	9	19	31	8	67	1	1	1	1	4	71
13	5	19	38	2	64	2	0	0	0	2	66
14	15	16	37	1	69	0	0	0	0	0	69
15	10	30	14	2	56	1	0	0	0	1	57
16	24	33	46	0	103	0	1	1	0	2	105
17	22	73	49	0	144	0	1	0	0	1	145
Total	832	1,187	1,329	1,231	9,579	962	1,229	1,360	1,270	4,821	9,400

[1] Data are from 0.1 percent CWHS. Deceased and disabled excluded.

Section 6. Classification of Earnings Histories[1]

The following classification scheme is designed to demonstrate and systematize the variety of shapes and levels of earnings histories of male workers which are shown in social security data files. The source for this study is the 0.1 percent 1937-72 Continuous Work History Sample. Male workers in three years of birth cohorts—1910-1911, 1920-1921, 1930-1931—are presented in order to assess the variation in earnings histories of workers passing through their working years before retirement.

In order to avoid the coverage problems in the early 1950's, only earnings in the years 1957-71 are used. Workers with no earnings in the period 1957-71 or having death or a social security disability benefit indication any time prior to 1-1-72 are excluded. The following table indicates the extent of the exclusions.

MALE WORKERS, 0.1 PERCENT 1937-72 CWHS

Year of birth	Zero earnings, 1957-71		Greater than zero earnings, 1957-71		Total
	Living	Deceased or disabled, Jan. 1, 1972	Living[1]	Deceased or disabled, Jan. 1, 1972	
1910-11	397	93	1,534	593	2,617
1920-21	537	85	2,284	260	3,166
1930-31	269	13	2,292	130	2,704

[1] Workers in this column are included in the analysis.

A. The Classification Variables

For workers alive (nonentitled) and active in the period 1957-1971, estimated total earnings are obtained for each year 1957-1971.

Estimated earnings = Farm wages + Self-employed net earnings + Estimated nonfarm wages

Early earnings are then wage indexed to the 1971 earnings level in order to remove the natural growth in average earnings over time. Using the fifteen years of waged indexed earnings, three measures are constructed for the classification scheme.

[1] Written by Herman Grundmann and Barry Bye, Office of Research and Statistics, Social Security Administration.

1. Average earnings per year, 1957-71

$$\bar{X} = \frac{\sum_{i=1}^{15} X_i}{15} \quad \text{where } X_i =$$

Estimated earnings for the ith year.

The fifteen-year period is then divided into three sections:

1957-1961, 1962-1966, 1967-1971, and we let:

A = Total earnings 1957-1961

B = Total earnings 1962-1966

C = Total earnings 1967-1971

Then define:
2. Trend ratio

$$T = \frac{C - A}{C + A}, \; T = 0 \text{ when } A = C = 0.$$

The trend will range from -1.0 to 1.0.

$T = -1.0$ (1.0) when all of the earnings in the first and third periods are concentrated in the first (third) period.

3. Profile ratio

$$P = \frac{B - (A + C)/2}{B + (A + C)/2}$$

The profile will range from -1.0 to 1.0.

If B equals the mean of A and C, P is equal to zero, the trend of earnings in the three subperiods is linear; that is, B lies on the line connecting A and C. If B exceeds the mean of A and C, P is positive, the curve connecting A, B, and C bulges above the straight line from A to C. Finally if B is less than the mean of A and C, P is negative, the curve connecting the three points A, B, and C sags beneath the straight line from A to C.

If $P = 1.0$, all of the earnings are in the middle period.

If $P = -1.0$, all of the earnings are in the first and/or third periods.

B. The Classification Scheme

In order to highlight the basic levels and shapes of earnings histories, three categories are constructed for each classification variable.
1. Average wage indexed earnings (base 1971)

Low earners = Less than $5,000 average earnings

Middle earners = $5,000–10,000 average earnings

High earners = Greater than $10,000 average earnings

These cutoff points, $5,000 and $10,000, approximate the 33rd and 67th percentiles for the total populations of workers (alive and active in the period 1957–71) from the three year of birth cohorts.

2. Trend ratio·

Decreasing = T less than $-1/9$

Level = T between $-1/9$ and $+1/9$

Increasing = T greater than $+1/9$

If C = 1.25, then

$$T = \frac{1.25A - A}{2.25A} = \frac{.25}{2.25} = \frac{1}{9}$$

So if C is 25 percent larger than A, the trend is classified as increasing. If A is 25 percent larger than C, the trend is termed decreasing. Otherwise the trend is said to be level.

3. Profile ratio

Sag = P less than $-1/9$

Linear = P between $-1/9$ and $+1/9$

Hump = P greater than $1/9$

Accordingly, if B is 25 percent larger than the mean of A and C, the earnings record is said to show a humped profile. If the mean of A and C is 25 percent larger than B, the profile is classified as showing a sag. Otherwise the profile is said to be linear.

Using this scheme, each earnings history will fall in one of 27 possible groups. (Average earnings × Trend × Profile = 3 × 3 × 3 = 27.)

Figures 1–3 show the results of the classifications separately for the three years of birth cohorts. The numbers in the left column of each figure represent the percentage of cases in the cohort that fell in each of the 27 possible groups. (The frequency counts are shown in parentheses in each cell.)

The charts in the right column of each figure show corresponding graphs of the mean earnings vectors for each of the 27 groups. The vertical scale of each graph is average wage indexed earnings in thousands. The horizontal scale represents the years 1957–1971. Any cell containing less than 2 percent (rounded) is not graphed in order to highlight major changes in shapes and levels between the three year of birth cohorts.

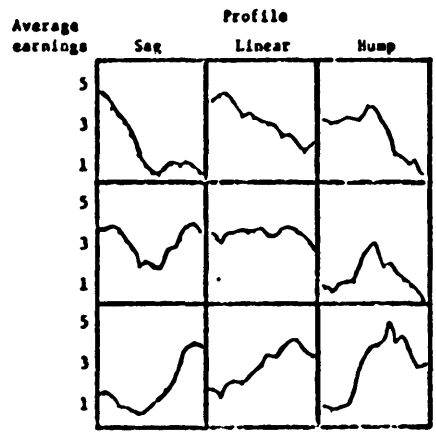
Male Workers

Year of Birth 1910-1911

Figure 1

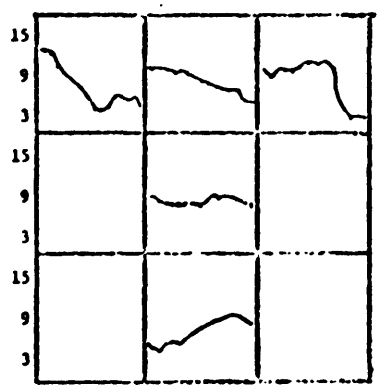
A. Low Earners

Trend	Sag	Linear	Hump	
	Profile			
Decreasing	8 (116)	3 (44)	3 (48)	14
Level	2 (33)	3 (42)	2 (24)	6
Increasing	6 (77)	4 (60)	3 (33)	13
	16	10	7	33



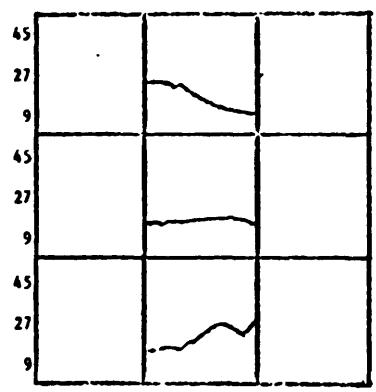
B. Middle Earners

Decreasing	2 (28)	5 (71)	2 (35)	9
Level	1 (22)	19 (298)	1 (17)	22
Increasing	1 (12)	5 (77)	1 (22)	7
	4	29	4	38



C. High Earners

Decreasing	1 (22)	4 (67)	1 (20)	7
Level	0 (6)	15 (228)	1 (13)	16
Increasing	1 (15)	4 (61)	1 (17)	6
	3	23	4	30



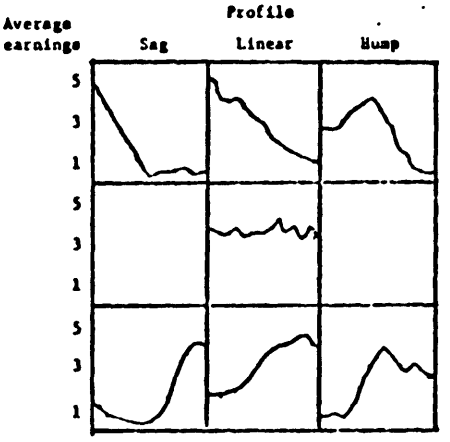
Male Workers

Year of Birth 1920-1921

Figure 2

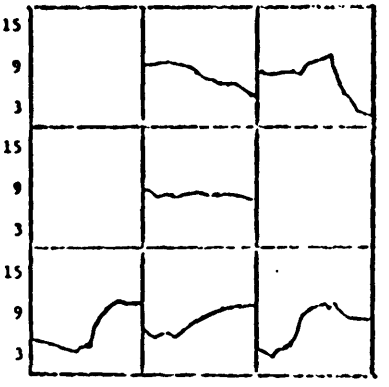
A. Low Earners

Trend	Profile: Sag	Linear	Hump	
Decreasing	7 (167)	2 (56)	2 (53)	12
Level	1 (33)	2 (45)	1 (25)	5
Increasing	7 (152)	3 (69)	3 (59)	12
	15	7	6	29



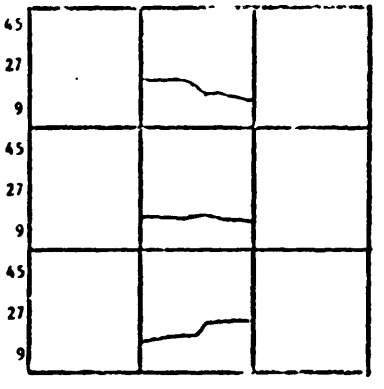
B. Middle Earners

Trend	Profile: Sag	Linear	Hump	
Decreasing	1 (30)	3 (76)	2 (54)	7
Level	1 (21)	15 (347)	1 (29)	17
Increasing	2 (41)	7 (152)	2 (45)	11
	4	25	6	35



C. High Earners

Trend	Profile: Sag	Linear	Hump	
Decreasing	1 (17)	2 (50)	1 (26)	4
Level	1 (15)	18 (415)	1 (34)	20
Increasing	1 (33)	9 (201)	1 (33)	12
	3	29	4	36



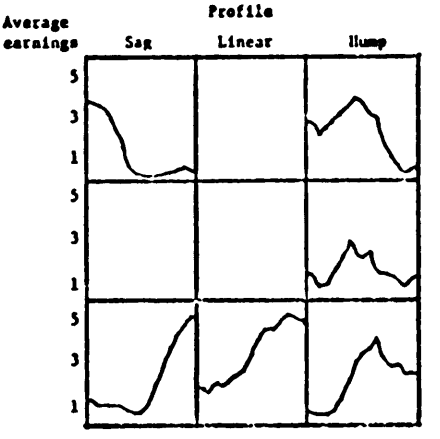
Male Workers

Year of Birth 1930-1931

Figure 3

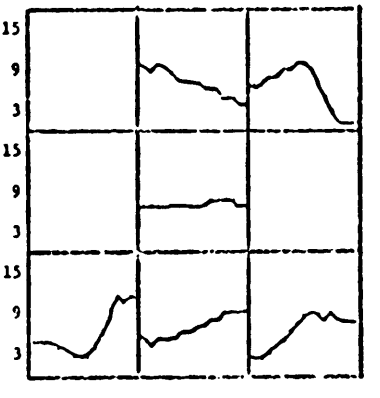
A. Low Earners

Trend	Profile: Sag	Linear	Hump	
Decreasing	7 (163)	1 (31)	3 (69)	11
Level	1 (28)	1 (16)	2 (35)	3
Increasing	8 (174)	5 (105)	4 (84)	16
	16	7	8	31



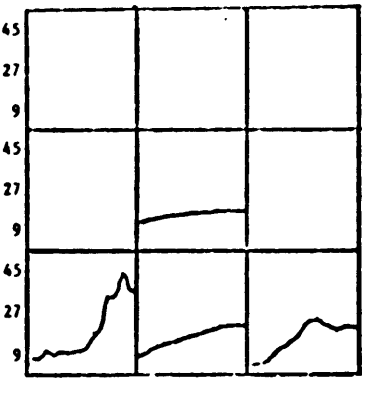
B. Middle Earners

Decreasing	1 (13)	2 (37)	2 (39)	4
Level	1 (23)	11 (251)	1 (23)	14
Increasing	3 (66)	15 (351)	4 (84)	22
	4	28	7	39



C. High Earners

Decreasing	0 (2)	0 (9)	1 (12)	1
Level	0 (9)	10 (224)	1 (19)	11
Increasing	2 (42)	13 (303)	3 (60)	18
	2	24	4	30



Appendix B

A Model of Lifetime Earnings Patterns[1]

1. Introduction

Social security law bases benefits on an average of the best years of earnings of an individual worker. Eventually retirement benefits will be based on the 35 years of highest earnings. This Panel has endorsed the principle of lifetime average earnings and recommends the eventual use of a 35-year average of indexed earnings. At present the averaging period is considerably shorter and no earnings before 1951 enter the calculation of benefits for most workers. To understand the future shape of the social security program and to have a model for cost estimation, it is thus necessary to have some understanding of the patterns of earnings over workers' entire lifetimes. No body of data exists which reports on the earnings of a large number of workers over full working lifetimes. Hence we have undertaken to estimate a model of lifetime earnings based on a large body of earnings data reported to the Social Security Administration since 1956.

At the start of this project, the 0.1 percent Continuous Work History Sample containing estimated[2] earnings for 1956 to 1971 was available. In addition the data for 1972 were available except for the level of self-employment earnings.[3] Since the primary purpose of the model was to project earnings histories into the future, we have fitted the model only to male earnings, given the belief that future female earnings are likely to differ sharply from those of the past.[4] The task was to move from this set of data containing up to 16 observations per person to a model giving the distribution, not just the average of lifetime earnings patterns.[5]

The model described below was used for simulations of wage histories which were used to project retirement benefits, yielding estimates in a form which could readily be incorporated into the long-run cost estimation procedure of the Office of the Actuary. An important conclusion of the simulation study is that cost estimates depend significantly on the specification of the random component of earnings growth as well as depending on the typical age structure of individual earnings.

In addition to being a basis for simulations, the model developed yielded a number of conclusions on the patterns of male earnings experienced over the time period analyzed, confirming the statistical findings described in Chapter 6 and Appendix A. Typically, until age 35 individuals experience wage growth that is much more rapid than the growth of average earnings in the economy. Between ages 35 and 64 individual earnings growth does not differ too much

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[1] This Appendix is based on the joint research of Peter Diamond, Richard Anderson, and Yves Balcer. The basic model was developed by Roger Gordon in his Ph.D. dissertation at MIT and adapted by him for Social Security data. Jerry Hausman has contributed a great deal of econometric advice. The calculations could not have been performed without the assistance of the Social Security Administration, especially Aaron Prero, Barry Bye, and John Spencer. Helpful suggestions have been made by a large number of others. Responsibility for errors and the like remain with Diamond, Anderson, and Balcer.

[2] We have used the Method II estimate which extrapolates earnings (separately by employer) for the remaining quarters of the year for any employee whose reported earnings reach the taxable maximum. In addition no estimate is available for self-employment income of those who earn above the maximum as employees.

[3] But we did have an indicator of whether self-employment earnings existed.

[4] We chose to make no use of data on location and industry of employer available starting in 1971.

[5] Earnings outside covered employment (e.g., for the U.S. government) are not reported. Thus we have zeros in the data both for people without earnings and for those working in uncovered jobs.

from the growth of the economy-wide averages for those who do not claim retirment benefits. There are large unexplained elements in individual earnings after one has adjusted for the typical age structure and for other components of steady growth. Adjusted for movements out of covered employment, the typical age structure of earnings does not vary much with the level of earnings between the upper two-thirds of the income distribution. It is different at the bottom of the income distribution showing a less rapid growth to the level of peak earnings. The random component in earnings is smaller in percentage terms the higher the income level.

2. Framework of Analysis

Ideally one would want to explore the determinants of earnings levels for different workers. This would imply an examination of the demand for and supply of labor of different ages, skills, experience levels, etc. Such an approach seemed considerably beyond the capabilities of this study. Thus we have taken the lesser task of examining the data on wages in the period 1956–71 in order to select a pattern of lifetime wages which is consistent with the observed pattern and a suitable extension to cover entire lifetimes. Restating this perspective, an individual's history can be considered as a random draw from some distribution defined over a 45 dimensional random vector representing annual earnings from ages 20 to 64. Given the outcome of this random draw, the highest 35 earnings in the single draw are selected to determine the average earnings of a particular worker. The problem is to describe the distribution.

If the distribution were believed to be multivariate normal, one could directly consider the 45 dimensional vector and estimate means, variances, and covariances where age differences were not too large.[6] A complete distribution could then be constructed by extrapolating the variance-covariance matrix to the unobserved off-diagonal terms. However, the distribution is very far from being multivariate normal.[7] Not knowing any suitable way to move from a variance-covariance matrix plus marginal distributions to either a full description of the distribution or to the needed order statistic (the mean of the 35 largest earnings), we have followed the route of making assumptions on lifetime patterns which lead to ordinary least squares regressions and an estimation of the distribution based on regression coefficients and the distribution of residuals.

3. Model[8]

Before considering the structure of the model, let us detail the earnings measure to be described. To avoid the issue of explaining both inflation and productivity growth, it seems appropriate to relate earnings of individuals in a particular year to average earnings in that year. There are several different average earnings series which might be used for this indexing purpose. It is not clear that there is a particularly correct index to use, in the absence of a theory of the impact of inflation, productivity gains and the age and sex mix of the labor force on the age structure of earnings. If one assumed no effects from these

[6] An estimate of the variance-covariance matrix is being calculated as an evaluation of the estimates developed below. The calculation was not ready in time to be included here.

[7] To examine normality in the distribution of earnings growth, five birth cohorts (1907–1911) were examined for two pairs of years. For each pair of years the logarithm of the ratio of estimated earnings in $t+1$ to estimated earnings in t was calculated for each worker with positive earnings in all three of $t-1$, t, and $t+1$. Then the distributions were calculated. In addition each cohort was divided into thirds by income in $t-1$ and the procedure repeated for each third. The distributions were consistently different from the normal distribution. The coefficients of skewness were mostly negative and generally less than -1. The coefficients of kurtosis were all positive and almost all larger than 10 and one-third larger than 20. The standard deviations were generally between 1/3 and 2/3.

[8] For a fuller description of this model and another use, see Chapter III of the unpublished MIT Ph.D. dissertation of Roger Gordon, "Essays on the Causes and Equitable Treatment of Differences in Earnings and Abilities." The model there was adapted for this problem by Gordon.

variables, a fixed weight average of earnings of different ages would be the correct measure. However, the analysis here uses a wage index constructed from includable[9] observations for all males age 20 and over who were in the smaller sample.[10] The average wage series is shown in table 1, along with the economy-wide average estimated covered earnings and average covered first quarter wages and salaries, the latter being the index used to increase the maximum taxable earnings base.

TABLE 1 MEAN WAGE INDEXES

Date	Annual earnings males 20 and over in sample	Estimated annual covered earnings	1st quarter wages and salaries	Annual earnings males 25 to 64 in sample
1956	$4 076	$3 207	$879	$4 638
1957	4 100	3 314	927	4 764
1958	4 177	3, 390	957	4, 805
1959	4 500	3 557	989	5 166
1960	4 693	3 656	1 032	5 428
1961	4 766	3 720	1 064	5 514
1962	4 899	3 890	1 109	5 734
1963	5 016	4 002	1 136	5 907
1964	5 223	4 191	1 171	6 232
1965	5 542	4 359	1 189	6 696
1966	5 963	4 618	1 241	7, 335
1967	6 151	4 852	1 320	7, 595
1968	6 565	5 147	1 413	8 175
1969	7 045	5 453	1 486	8 787
1970	7 530	5 733	1 563	9 396
1971	7 863	6 013	1 658	9 833
1972	8 098	6 399	1 802	10, 244

To test the importance of the choice of index, the basic equation was re-estimated using another index shown as column five in the table. When the coefficients are adjusted for the more rapid growth of the alternative average earnings series (approximately 0.5 percent per year average) they are essentially the same.

Given the complexities (and lack of importance for these purposes) associated with earnings of the young, no earnings before age 20 are considered. In addition no attempt was made to estimate earnings of those over 64. The presence of social security makes the determinants of the earnings of the elderly (primarily the retirement test) somewhat different from those of younger workers. With the need to register for medicare benefits, registration for social security benefits is not a useful indicator of partial retirement for those over 65 for much of the data period. The expectation that the random structure of the model is more likely to be multiplicative than additive led to a formulation in logarithms.[11] Thus the variable to be explained is defined as

$$W_t^h = \log\left(\frac{\text{earnings of person } h \text{ in year } t}{\text{average earnings in year } t}\right) \qquad (1)$$

In addition W^h is defined as the average of the W_t^h taken over the years when earnings are positive.

A problem inevitably arises in treating years when earnings are zero. It was decided not to attempt to simultaneously estimate the probability of zero and the distribution of earnings when positive, but to proceed on the assumption that the two parts are separable,[12] treating all zeros as missing observations.[13]

[9] The definition of the set of observations included in the analysis will be given below.

[10] The index was calculated using approximately twice as many persons as were used in the regressions.

[11] No attempt was made to examine whether some other transformation of earnings was a more appropriate one to use in a linear regression.

[12] For a rudimentary model of the probability of a zero, see section 12, below. For the relative frequency of zeros by income level, see section 7.

[13] In addition, with death or receipt of retirement benefits during a year, the earnings of that year or any later year were eliminated from the sample. Earnings in years with receipt of disability benefits were also eliminated. With retirement late in a year, this would be the procedure to evaluate benefits on retirement but not necessarily on recomputation a year later.

That is, earnings are estimated conditional on being positive. The assumption for estimation purposes is that for an individual the probability of a zero is independent of the earnings record which would occur in the absence of zeros, although it may vary with age and permanent characteristics of an individual. No further adjustments are made for these missing observations, since the procedure followed is unbiased and while such adjustments would affect efficiency, the sample is quite large. Before examining further refinements made to adjust for the presence of zeros in neighboring or previous years, let us consider the basic model relating this earnings variable to age.

The basic assumption of the model is that the path of expected values of W_t^h has the same slope for all people, but with different heights for different people. That is, in a log wage-time diagram all people follow parallel paths, randomness aside, but intercepts differ across individuals. The assumption that the steepness of income growth paths does not vary significantly with income level may seem surprising to some. Some support for this assumption except at low incomes was described in Appendix A. Below in sections 7 and 9 we will consider further evidence that this assumption is a reasonable one, for all but the lowest income level. We will also consider a modification of the model to allow for systematically different individual paths, although the modification was not pursued very far. To express the model formally let us define a set of age variables A_{it}^h,

$$A_{it}^h = \begin{cases} 1 & \text{if person } h \text{ becomes } t \text{ years old in year } t \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

Then the basic model is

$$W_t^h = a^h + \sum_{t=20}^{64} b_t A_{it}^h + u_t^h \tag{3}$$

where a^h is the coefficient on an individual dummy [14] and u_t^h is a random variable with zero mean and finite variance. The problem is to estimate the distribution of a^h, the coefficients b_t, and the distribution of random errors u_t^h.

The procedure is to pool all the W_t^h for all people and all years in a single ordinary least squares regression. There are two basic assumptions underlying this formulation: first, that the expected path of log earnings has the same slope for all people, second, that the individual characteristics which determine the height of the path stay constant over a lifetime. The slope assumption will be discussed further below. To assume a lifelong individual constant is to assume that all deviations from the trend are captured in the structure of the random elements u_t^h in the wage equation (3). The two structures examined are u_t^h independent random variables [15] and u_t^h having a first order autocorrelation structure

$$u_t^h = \rho u_{t-1}^h + v_t^h \tag{4}$$

where v_t^h are independent random variables. Given the absence of explanatory variables other than age and presence in covered employment, this random structure does not seem adequate to capture large changes in general earnings, whether through changes in earning ability (e.g., health) or taste. In particular it might be interesting to explore a model where the individual constants could

[14] An individual dummy is 1 for the wage observations of the particular individual and zero otherwise.

[15] Not necessarily identically distributed for different ages.

change withing a lifetime.[16] Since the model is fitted to a 16-year period and then used for simulation over a 45-year period, this misspecification probably involves too few large changes within a lifetime and too much short period noise as the random elements attempt to capture both of these effects.

4. Age Structure Variables

To directly employ equation (3) on a large body of data would not be appropriate since there would be an inconvenient number of right hand side variables—45 plus the number of people in the sample. The procedure actually followed was that of subtracting the means of all variables for each person from the values of the variables. Thus the equation fitted became

$$W_t^h - \bar{W}^h = \sum_{i=20}^{64} b_i (A_{it}^h - \bar{A}_i^h) + u_t^h \tag{5}$$

Since this equation would give too many coefficients to be easily handled, for the ages 20 to 59, they are constrained to be piecewise linear in 5-year intervals.[17] The procedure is to define 9 dummy variables A'^h_{jt} defined over the values (0, 0.2, 0.4, 0.6, 0.8, 1) reflecting the five-year intervals between 20 and 60. An individual whose age is a multiple of 5 in a year would have the appropriate dummy set equal to one, all other dummies being zero. For a year when a person's age is not a multiple of five, two dummies, representing the neighboring multiples of five are nonzero, with the weights (adding to one) such that his age is a weighted average of the two five-year points. Thus a 22-year-old has A'_1 equal to 0.6, A'_2 equal to 0.4 and all other dummies set equal to zero. Thus the fitted equation became

$$W_t^h - \bar{W}^h = \sum_{j=1}^{9} b'_j (A'^h_{jt} - A'^h_j) + \sum_{i=61}^{64} b_i (A_{it}^h - A_i^h) + u_t^h \tag{6}$$

Because the complete set of age variables display perfect collinearity, the dummy for age 50 is omitted in the regression. Hence coefficients measure the difference between the coefficient for some other age and that for age 50.

The equation was fitted to two bodies of data—a subsample of the 0.1 percent CWHS of 1,576 persons (16,747 observations), on which we tried out different models and tested some ideas, and the entire 0.1 percent CWHS of 65,119 persons (689,377 observations). The results for this equation are reported in tables 3 and 4 and discussed in section 6 below. Given the large size of the samples, in the estimation no adjustments are made for heteroskedasticity or autocorrelation of u_t^h.

5. Dummy Variables for Noncovered Employment

The formulation in the previous section makes no use of the available information on the absence of all covered earnings in some years. In addition, consideration of the presence of a zero in the earnings history together with the method of estimating earnings for this data set indicate an error in the data that requires further adjustment. Let us start with the use to be made of zeros in an earnings record.

As indicated at the start, a separate model is being estimated to yield the probability of positive earnings in a year. In wage simulation, one then combines a simulation of positive earnings with a probability of zeros in the earnings

[16] The importance of changes in the individual constant could be tested somewhat by examining earnings predictions for 1972 using different length periods to estimate the individual constants (but the same age structure of earnings). If the individual constants are stable, the longer the time period used in their estimation the better the estimate. If they are not stable, use only of recent years might give a better estimate.

[17] In retrospect, the ages 20 to 25 should also have been fitted separately since the growth rate seems to vary considerably between those years.

record. Thus if the presence of a zero does affect earnings levels in other years, it would be appropriate to include such an effect in the simulation. Most commonly, one would expect a zero in an earnings record to represent employment in noncovered employment.[18] In addition, some zeros result from unemployment of long duration or withdrawal from the labor force.[19] It is unlikely that such departures from covered employment exactly coincide with calendar years. With a distribution of shifts between covered and noncovered employment spread throughout the year, one would expect an effect in the years before and after any spell of at least a year out of covered employment. Hence two more dummy variables are defined to measure this effect. For a year one year after a zero, we define shock one, S_1 and for a year one year before a zero, anticipatory shock AS:

$$S_{1t}^h = \begin{cases} 1 & \text{if earnings of } h \text{ are zero in year } t-1 \\ 0 & \text{otherwise} \end{cases}$$

$$AS_t^h = \begin{cases} 1 & \text{if earnings of } h \text{ are zero in year } t+1 \\ 0 & \text{otherwise} \end{cases} \tag{7}$$

One can now add these two additional variables to the basic regression equation (3) or (6). Since the information is available, the importance of zeros in earlier years is also examined. The formulation allows just one shock for the most recent past zero year. Some tests to allow for several recent zeros produced fairly similar results. Defining 5 shock variables for past zeros we have:[20]

For $i = 1, 2, 3, 4, 5$:

$$S_{it}^h = \begin{cases} 1 & \text{if earnings of } h \text{ are zero in year } t-i \\ & \quad \text{and positive in all years from} \\ & \quad t-i+1 \text{ to } t. \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

Thus 6 different shock variables are included in the model:

$$W_t^h - \bar{W}^h = \sum_{j=1}^{5} b_j'(A_{jt}'^h - \bar{A}_j'^h) + \sum_{i=61}^{64} b_i(A_{it}^h - \bar{A}_i^h) + \sum_{k=1}^{5} d_k(S_{kt}^h - \bar{S}_k^h) + e(AS_t^h - \overline{AS}^h) + u_t^h \tag{9}$$

Before proceeding to the fitted equations including these additional dummies, let us identify the data problem associated with the anticipatory shock variable and discuss the two methods employed to deal with the problem. For an employee whose earnings from a particular employer exceed the taxable maximum, the data tape contains an estimate of annual earnings. The estimate is constructed by extrapolation to the remainder of the year of the earnings in the quarters before the quarter in which the maximum is reached.[21] A measurement problem naturally arises for an individual who ceases working in covered employment (or changes employers) after reaching the taxable maximum. One signal of individuals who may have ceased working during a year is the absence of any covered earnings in the following year. Thus there are two problems—

[18] For purposes of analysis of the effects of zeros, years of death, disability, or retirement are not considered to be zeros even though their values are excluded from the estimation.

[19] It is estimated that approximately 90 percent of paid employment is covered (Table 27, *Annual Statistical Supplement, 1973, Social Security Bulletin*).

[20] Although estimated earnings are only available starting in 1956, actual earnings up to the taxable maximum are available starting in 1937. Thus there were no problems with use of these dummies for all years.

[21] A single number was used each year for workers reaching the maximum in the first quarter.

estimated earnings are too high whenever a man stops working after reaching the taxable maximum in a year and this situation is far more likely to occur in a year preceding a year with a zero. Thus simply fitting the model as described would give a coeffi · · for anticipatory shock which is strongly biased toward zero (since the effect to be measured is set to zero by the data construction process for a large fraction of workers)[22] and the combination of mismeasurement of earnings and a biased coefficient may bias the estimates of other coefficients.

One procedure[23] to obtain unbiased estimates of the other coefficients is to eliminate from the data set all observations coming before a year of zero earnings. Results of using this procedure are described in table 5. Of course, no estimate of the coefficient for anticipatory shock can be obtained in this way. This procedure was suggested to us too late to redo the analysis of residuals, which is therefore based on the procedure to be described next. Fortunately, the coefficient estimates do not differ by a great deal between the two procedures.

The alternative procedure is to define anticipatory shock as only being present when a worker is below the taxable maximum; that is, when the measurement error is not present:

$$AS_t'^{A} = \begin{cases} 1 & \text{if earnings are zero in year } t+1 \text{ and} \\ & \quad \text{below the taxable maximum in year } t \\ 0 & \text{otherwise} \end{cases} \tag{10}$$

This procedure also results in a biased estimate of the coefficient, with the bias being away from zero (i.e., towards a larger estimated decline in earnings from this effect). The problem is that the subset of individuals with zeros in t + 1 who are included in the measurement for AS' is not a random sample. Rather the set includes those with low earnings in year t. Those with larger effects from anticipatory shock are more likely to be included in the sample, i.e., more likely to have low earnings. Thus the coefficient will be biased away from zero. Since the other coefficient estimates are similar under the different formulations of the model to deal with this problem, it was felt to be appropriate to adopt the hypothesis that remaining biases are small.

6. Coefficient Estimates

The details of the coefficient estimates (apart from the individual constants) appear in tables 3–5. For ease of discussion, table 2 contains the coefficient estimates in ratio terms,[24] without the statistical details. The typical lifetime path of wage-indexed earnings is also shown in Figure 1. Before considering the particular coefficients, we can consider statistical significance and goodness of fit. By the conventional t-test, for the larger sample almost all the coefficients are extremely significant.[25] The reported goodness of fit for the explanation of deviations of individual earnings from individual means is small although the standard error of estimate is reasonable. Since the purpose of the model is to simulate lifetime histories, the vastly greater coefficient of closeness of fit that would appear from considering the entire equation (including individual constants) is not really relevant.[26] The equation demonstrates that there is a

[22] A worker who reaches the maximum in the second quarter and then leaves covered employment will be recorded as having four times his first quarter earnings (assuming they exceed his second quarter earnings). Thus there would be no measured decline in earnings as a result of his departure from covered employment.

[23] This procedure was suggested by Franklin Fisher.

[24] Table 2 was obtained by raising e to the power of the coefficients in Table 3 for the column with all variables, S_1–S_5 and AS'_t (i.e., taking the natural antilogarithm).

[25] The coefficients measure log earnings relative to those of a 50-year-old. Thus the t statistic tests the hypothesis that individuals of a particular age are distinguishable from 50-year-olds, the coefficient for a 50-year-old having been set to zero.

[26] We are interested in the explanation of variations in a typical individual's history, not in explaining the differences in income level across people by dummy variables.

significant average age-structure to individual earnings which does explain some considerable fraction of the variation in earnings over all lifetimes, while leaving a considerable degree of randomness in earnings which will also be a major component of the simulation to be described below. In addition, the shock dummies also explain a good deal of the variation in deviations from individual means.

Examining the coefficients on the age variables in the different equations, there are several conclusions to be drawn. [37]

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[37] Note that the same wage index was used in all the regressions reported in Tables 3–5.

Fig. 1 Ratio of wage indexed earnings to earnings at age 50

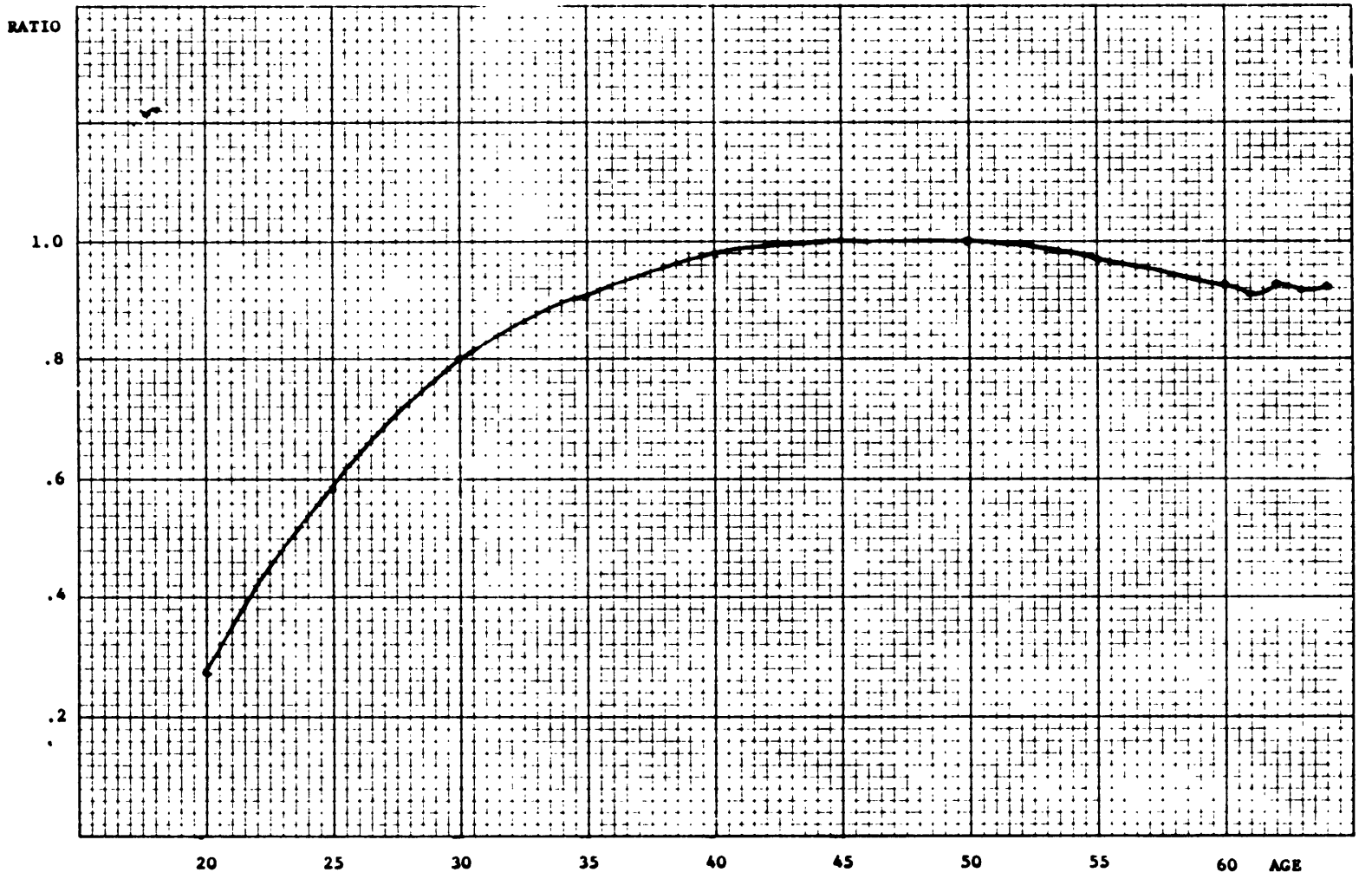

TABLE 2

Coefficient estimates based on 0.1 percent CWHS.
Numbers reported are ratios of wage-indexed earnings at a particular age to earnings at age 50 based on the equation with all variables.
For statistical details see Table 3.

Variables	
Ages	
20	0.273
25	.589
30	.783
35	.886
40	.961
45	.994
50	1.0
55	.978
60	.954
61	.921
62	.947
63	.933
64	.926
Shock variables for previous zero	
1 year earlier	.455
2 years earlier	.774
3 years earlier	.868
4 years earlier	.927
5 years earlier	.954
Shock variable for zero in following year	.388

First, there is very rapid earnings growth for young workers (up to age 35). Second, wages of older workers (40 to 64) do not vary much from the trend in average wages in the economy. Third, the coefficients describing earnings growth are quite stable across the different formulations of the earnings equation and the different samples.[28]

TABLE 3.—COEFFICIENT ESTIMATES BASED ON 0.1 PERCENT CWHS

(65,119 persons, 689,377 observations)

Regression	No shock dummies		S_1		S_1–S_5		S_1–S_5 and AS*	
	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors
Variables								
Ages								
20	−1.347	(0.007)	−1.297	(0.007)	−1.264	(0.007)	−1.299	(0.007)
25	−.588	(.006)	−.539	(.006)	−.512	(.006)	−.530	(.006)
30	−.237	(.006)	−.226	(.006)	−.215	(.006)	−.245	(.006)
35	−.101	(.005)	−.097	(.005)	−.094	(.005)	−.122	(.005)
40	−.022	(.005)	−.020	(.005)	−.018	(.005)	−.040	(.005)
45	.004	(.005)	.005	(.005)	.006	(.005)	−.006	(.005)
50								
55	−.032	(.005)	−.032	(.005)	−.032	(.005)	−.022	(.005)
60	−.071	(.006)	−.072	(.006)	−.073	(.006)	−.047	(.006)
61	−.088	(.008)	−.092	(.008)	−.094	(.008)	−.083	(.008)
62	−.063	(.009)	−.068	(.009)	−.070	(.009)	−.054	(.008)
63	−.075	(.010)	−.083	(.009)	−.086	(.009)	−.069	(.009)
64	−.066	(.011)	−.075	(.011)	−.080	(.011)	−.078	(.010)
Shock variables for previous zero								
1 year earlier			−.648	(.005)	−.707	(.005)	−.767	(.005)
2 years earlier					−.205	(.005)	−.256	(.005)
3 years earlier					−.098	(.005)	−.142	(.005)
4 years earlier					−.036	(.005)	−.076	(.005)
5 years earlier					−.013	(.006)	−.047	(.005)
Shock variable for zero in following year							−.948	(.005)
R^2	.092		.117		.120		.176	
Standard error of estimate	.380		.369		.368		.344	

[1] Numbers reported are logarithm of ratio of wage-indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock

[28] Estimated earnings (relative to age 50) based on different formulations all differ by less than 15 percent.

TABLE 4.—COEFFICIENT ESTIMATES BASED ON SMALLER SAMPLES

[1,576 persons, 16,747 observations]

Regression	No shock dummies		S_1		S_1-S_2		S_1, S_2, and AS'		S_1 and AS'	
	Rate of wage-indexed earnings[1]	Standard errors	Rate of wage-indexed earnings[1]	Standard errors	Rate of wage-indexed earnings[1]	Standard errors	Rate of wage-indexed earnings[1]	Standard errors	Rate of wage-indexed earnings[1]	Standard errors
Variables										
Ages										
20	−1.425	(0.048)	1.358	(0.047)	−1.312	(0.047)	−1.324	(0.046)	−1.380	(0.046)
25	−.645	(.043)	.603	(.042)	−.564	(.043)	−.567	(.042)	−.615	(.041)
30	−.337	(.040)	.311	(.039)	−.289	(.039)	−.308	(.038)	−.334	(.038)
35	−.157	(.037)	.138	(.037)	−.128	(.036)	−.141	(.036)	.153	(.036)
40	−.057	(.033)	−.048	(.033)	−.038	(.032)	−.049	(.032)	−.061	(.032)
45	−.023	(.034)	−.010	(.033)	−.005	(.033)	−.007	(.032)	−.012	(.032)
50										
55	−.044	(.036)	−.038	(.035)	−.035	(.035)	−.025	(.034)	−.028	(.035)
60	−.021	(.042)	−.025	(.041)	−.024	(.041)	.006	(.040)	.004	(.040)
61	−.070	(.057)	−.086	(.056)	−.089	(.056)	−.080	(.054)	−.077	(.054)
62	−.071	(.063)	−.066	(.062)	−.076	(.062)	.059	(.060)	−.048	(.061)
63	−.082	(.069)	−.086	(.068)	−.093	(.068)	−.084	(.066)	−.075	(.066)
64	−.055	(.074)	−.062	(.073)	−.070	(.072)	−.058	(.070)	−.048	(.071)
Shock variables for previous zero:										
1 year earlier			−.685	(.030)	−.778	(.032)	−.831	(.031)	−.716	(.029)
2 years earlier					−.288	(.033)	−.333	(.032)		
3 years earlier					−.162	(.033)	−.202	(.033)		
4 years earlier					−.102	(.035)	−.141	(.034)		
5 years earlier					−.032	(.036)	−.064	(.035)		
Shock variable for zero in following year							−.827	(.029)	−.807	(.029)
R^2	.090		.120		.125		.169		.162	
Standard error of estimate	.414		.401		.398		.378		.381	

[1] Numbers reported are logarithm of ratio of wage indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock

TABLE 5.—COEFFICIENT ESTIMATES BASED ON SMALLER SAMPLE EXCLUDING YEARS BEFORE ZEROS

[1,528 persons, 16,010 observations]

Regression	No shock dummies		S_1		S_1, S_2	
	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors
Variables						
Ages						
20	−1.454	(0.048)	−1.376	(0.044)	−1.407	(0.044)
25	−.656	(.040)	−.605	(.040)	−.648	(.041)
30	−.347	(.038)	−.317	(.037)	−.283	(.037)
35	−.159	(.035)	−.140	(.034)	−.124	(.034)
40	−.042	(.031)	−.028	(.030)	−.015	(.030)
45	−.001	(.031)	.009	(.031)	.016	(.031)
50						
55	−.027	(.034)	−.025	(.033)	−.024	(.033)
60	.012	(.040)	.011	(.039)	−.002	(.039)
61	−.062	(.052)	.082	(.051)	.088	(.051)
62	−.050	(.058)	.054	(.057)	.068	(.057)
63	−.079	(.064)	.091	(.063)	.103	(.062)
64	−.039	(.068)	−.051	(.067)	−.063	(.066)
Shock variables for previous zero						
1 year earlier			−.728	(.031)	−.845	(.033)
2 years earlier					−.529	(.032)
3 years earlier					−.169	(.032)
4 years earlier					−.152	(.033)
5 years earlier					.085	(.034)
R^2	.109		.143		.150	
Standard error of estimate	.345		.332		.329	

[1] Numbers reported are logarithm of ratio of wage-indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock

The only curious numbers in the tables are the dips in age 61 earnings relative to neighboring years. Recalling that age 62 is the minimum age for early retirement, one would expect workers who are doing poorly relative to their own life histories to be more likely to collect social security benefits[20] and so be excluded from the sample for analysis. Thus it seems reasonable to conclude

[20] From information on early retirees, it is true that those with low lifetime records do, on average, retire earlier. This is a somewhat different proposition from the speculation in the text.

that there would be a noticeable decline in typical earnings trajectories if early retirement were not an available option.[30]

Considering the coefficient estimates on the shock dummies for zeros in the recent past we have a somewhat different picture. The estimates do vary somewhat across formulations, although not enormously.[31] There is the curious puzzle of the systematic and large (relative to the conventional standard error estimate) differences between the equations fitted to the smaller sample and those fitted to the entire 0.1 percent CWHS.[32] We shall argue that the numbers are in the range of plausible values, so it does seem appropriate to base the simulation on the estimates from the larger sample, adjusting arbitrarily for the bias in the estimate of the coefficient on anticipatory shock. If there were no effect of past zeros other than the carry-over of noncovered employment into the year after a zero, and if switches to covered employment were uniformly distributed over a year, the coefficient of shock one would be one-half. There are three complications to add to this argument. First, there is probably a strong seasonal pattern to job switching. Given the suspicion that moves are concentrated in the late spring and early fall (with more in the former), the seasonal pattern may not affect the argument greatly. Second, there is a complication even if all job switches were uniformly distributed over the year. If the distribution of lengths of time out of covered employment were the same for all dates of switching, the fraction of switches coming after a period out of covered employment which includes an entire calendar year would decrease with the time of the year.

Thus, on average the coefficient on shock one should represent an earnings decrease of less than 50 percent. Third, switching probably lowers earnings[33] (at least in part since some switchers are coming from unemployment or nonparticipation in the labor force) implying a coefficient larger than one-half in absolute value. From these considerations, the estimates of shock one seem to be in a plausible range. The other coefficients for the effects of past zeros show a steady decline in the effects of a previous absence from covered employment, as one would expect.

The estimate of the effect of a zero in the year following a particular year seems too large. Comparing the coefficient with that of shock one, the above argument based on a uniform distribution in the timing of job switches, works in the same way. The seasonal pattern probably makes the effect of anticipatory shock larger. The relationship between switching and earnings is probably weaker. Thus it seems reasonable to expect that the decline in earnings for anticipatory shock is roughly the same as that from shock one. As was discussed above there are reasons to think that this estimate is biased away from zero. In future estimation it would be interesting to develop alternative procedures to obtain an unbiased estimate of this coefficient. The movement in and out of covered employment is sufficiently slow that the exact parameter values on the effects of a zero are not critical components in cost estimation.

To test the robustness of the procedure, the same model was fitted with two modifications. One is the use of a different wage index—the average male earnings of 25- to 64-year olds in the smaller sample. (The index is shown in table 1.) Comparing first and last years, the new wage series shows 5.14 percent growth per year over the period, while the series used above shows 4.48 percent growth per year. This difference of 0.66 percent per year is important for comparing the two regression results. The second modification is to eliminate all observations on 20–24 year olds. Since many of these workers may have been in school and may have had covered earnings from part-time jobs, their

[30] For further discussion of this point see section 10.

[31] Estimated earnings based on different formulations vary up to 20 percent.

[32] The fact that the distribution of the residuals is very far from normal might play a role in explaining the magnitude in differences, but not the persistent sign of the difference in coefficients. Possibly relevant is the fact that the smaller sample was not randomly selected from the CWHS.

[33] This expectation is consistent with significant coefficients for earlier shocks.

inclusion might be affecting the other age coefficient estimates by affecting the estimates of a^h, the individual constants. The results are reported in table 6 including a regression using the wage series for those 20 and over for the sake of comparison.

TABLE 6.—COEFFICIENTS WITH ALTERNATIVE WAGE INDEX

Regression	Index of mean wage, 25 to 64 excluding 20-to-24-year-olds		Index of mean wage, 25 to 64			Index of mean wage, 20 and over	
	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors	Adjusted coefficients	Ratio of wage-indexed earnings[1]	Standard errors
Variables							
Ages							
20			−1.110	(.046)	−1.308	−1.324	(0.046)
25	−0.415	(0.042)	−.388	(.042)	−.553	−.557	(.042)
30	−.155	(.036)	−.167	(.038)	−.299	−.308	(.038)
35	−.028	(.034)	−.035	(.036)	−.134	−.141	(.036)
40	.025	(.030)	.022	(.032)	.044	−.049	(.032)
45	.031	(.030)	.028	(.032)	−.005	−.007	(.032)
50							
55	−.060	(.033)	−.061	(.034)	−.028	−.025	(.034)
60	−.067	(.038)	−.066	(.040)	−.000	−.006	(.040)
61	−.161	(.051)	−.159	(.054)	−.086	−.080	(.054)
62	−.146	(.057)	−.143	(.060)	−.064	−.059	(.060)
63	−.177	(.063)	−.174	(.066)	−.088	−.084	(.066)
64	−.159	(.067)	−.155	(.071)	−.063	−.058	(.070)
Shock variables for previous zero							
1 year earlier	−.891	(.034)	−.832	(.031)		−.831	(.031)
2 years earlier	−.419	(.035)	−.332	(.032)		−.333	(.032)
3 years earlier	−.273	(.036)	−.202	(.033)		−.202	(.033)
4 years earlier	−.167	(.036)	−.140	(.034)		−.141	(.034)
5 years earlier	−.095	(.037)	−.062	(.035)		−.064	(.035)
Shock variable for zero in following year	−.795	(.030)	−.825	(.029)		−.827	(.029)
R^2	.113		.157			.169	
Standard error of estimate	.338		.377			.378	
Persons	1,369		1,576			1,576	
Observations	14,235		16,747			16,747	

[1] Numbers reported are logarithm of ratio of wage indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock.

The second column contains the regression results using the alternative wage index and ages 20–64. The third column contains the same coefficients adjusted for the difference in wage indexes. The column was constructed by adding to each age coefficient 0.0066 (Age-50). For comparison purposes the fourth column repeats the coefficients reported in table 4 above.

Comparing the latter two columns, one has little difference in the estimates of wage growth resulting from use of these two wage indexes. Column one contains the coefficient estimates when workers aged 20–24 are omitted from the sample. Comparing columns one and two we see that the age coefficients from the two regressions are very similar. Thus inclusion of 20–24 year olds is not seriously affecting the estimates of the age structure. However, the coefficients on the shock dummies do change somewhat, suggesting, as one might expect, that zeros have somewhat different meanings for the very young than for older workers. Past zeros are more important for prime workers than for young workers.

7. Individual Constants

Given the parameter estimates described above, estimates of individual constant terms, a^h, are obtained from the basic equation (9) using the fact that the estimated error is zero when all variables are at their individual means. There are several uses of these constants which are of interest. First, one wants the distribution of the constant terms as an integral part of the cost estimation. The cohorts born between 1926 and 1931 were pooled to develop an estimate of the distribution of individual constants. Using the coefficients from the equation with all shock dummies fitted to the complete 0.1 percent CWHS, the a^h were estimated for the 188 members of these cohorts in the smaller sample.[84] The calculated distribution of a^h has the shape shown in Figure 2. It is interesting that the distribution is distinctly different from normal.

[84] No further adjustment was made for the different numbers of observations used to estimate the different a^h

Figure 2 Density of individual constants
(mean = -.113
variance = .59)

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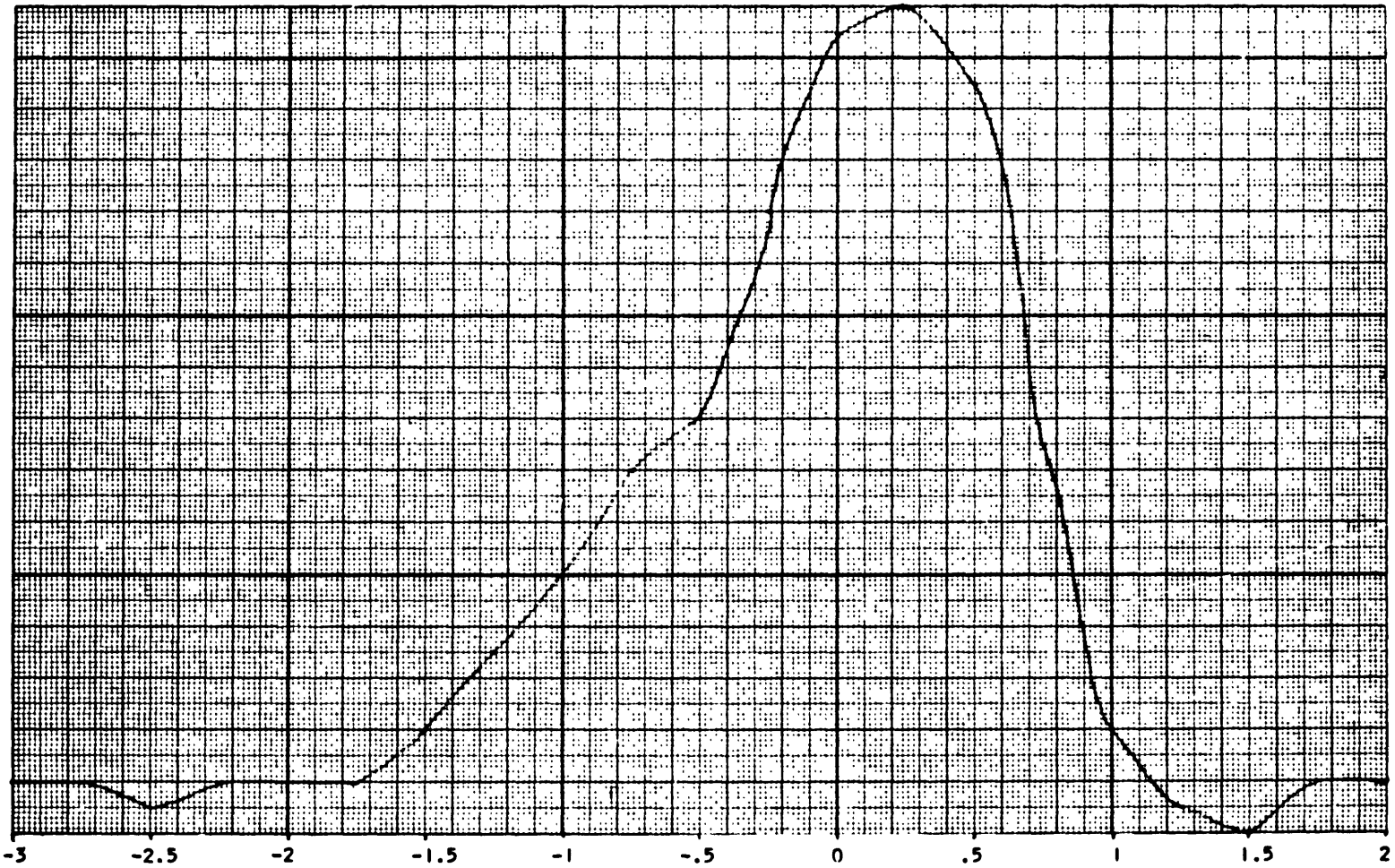


Second, one is interested in the stability of the distribution over successive cohorts. Estimates of a^h for all individuals in the smaller sample were calculated using the equation with all shock dummies fitted to the smaller sample. The means of a^h by cohort were calculated and are shown in table 7.[36]

TABLE 7 MEAN INDIVIDUAL CONSTANT (a^h) BY COHORT

[a^h is estimated from coefficients from regression in Table 4 with all variables]

Date of birth	Mean	Date of birth	Mean	Date of birth	Mean
1893	-0 600	1912	221	1932	021
1894	555	1913	285	1933	140
1895	- 112	1914	353	1934	057
1896	003	1915	146	1935	139
1897	636	1916	202	1936	- 116
1898	739	1917	413	1937	137
1899	395	1918	213	1938	145
1900	465	1919	501	1939	153
1901	208	1920	280	1940	158
1902	488	1921	197	1941	062
1903	988	1922	108	1942	176
1904	236	1923	154	1943	198
1905	-- 424	1924	206	1944	251
1906	601	1925	037	1945	011
1907	529	1926	038	1946	044
1908	- 374	1927	219	1947	104
1909	036	1928	059	1948	082
1910	- 639	1929	202	1949	200
1911	- 428	1930	168	1950	040
		1931	139		

There is a distinct positive trend in these means indicating that later cohorts have, on average, higher earnings paths relative to the rest of the economy than do earlier cohorts.[36] While one might identify many differences between cohorts and differences in the underlying economy[37] which would justify such a trend, any such discussion would be purely speculative in the absence of further analysis of earnings determination. The trend does not appear so large as to vitiate the use of a single model and single distribution of individual constants for cost estimation, although it might be an improvement to examine[38] the determinants of a^h (using a body of data with more individual information) and to extrapolate the pattern into the future.

Third, the estimates of individual constants can be used to test whether the age profiles of earnings are the same for different earnings levels. For this purpose the equation and sample omitting years before zeros was employed. The a^h in each cohort were divided into thirds representing high, medium, and low levels. Then the earnings records of all individuals who had a^h in the top one-third of their cohorts were combined to form a single sample. The basic equation was fitted to this sample. The same procedure was followed for low and middle thirds. The estimates for these three equations are shown in Table 8. The age structures are graphed in Figure 3.

---

[36] Since observations per person and residuals per person both decrease with earnings level, a weighted mean would have produced biased estimates of the mean a^h in a cohort.

[36] No test has been made of the statistical significance of this trend.

[37] For example, the shift in the age structure of the male labor force will affect the economy-wide mean earnings series.

[38] In his Ph.D dissertation, Roger Gordon has examined some of the factors affecting a^h, using the Michigan Panel Study data.

Fig. 3 Ratio of wage indexed earnings to earnings at age 50 for different income levels

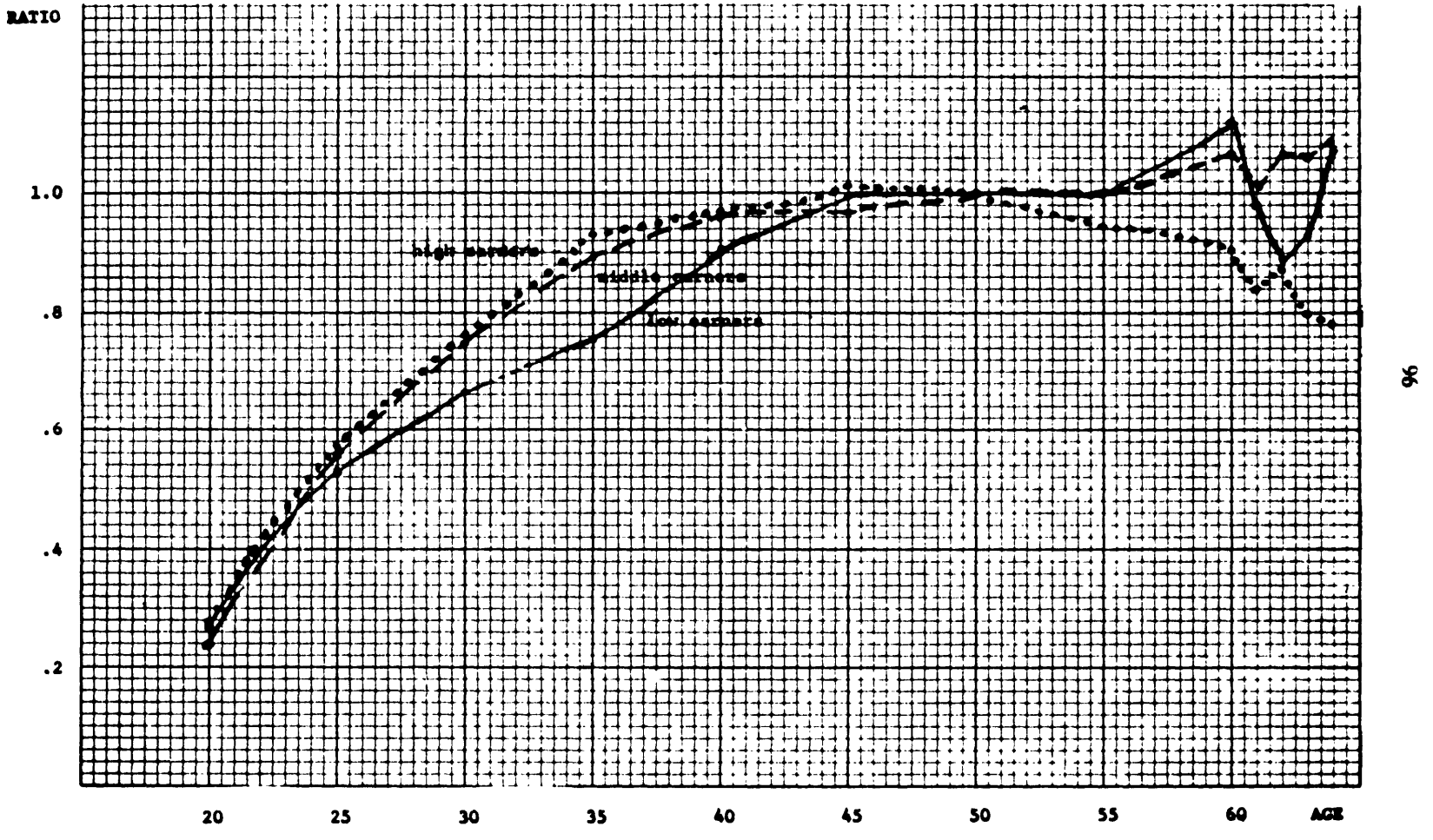


TABLE 8.—COEFFICIENT ESTIMATES FOR DIFFERENT INCOME GROUPS

Regression	Low 3d		Middle 3d		High 3d		Entire population	
	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors	Ratio of wage-indexed earnings[1]	Standard errors
Variables:								
Ages								
20	−1.310	(0.137)	−1.427	(0.059)	−1.294	(0.045)	−1.324	(0.046)
25	− .634	(.126)	− .584	(.054)	− .557	(.040)	−.567	(.042)
30	− .408	(.117)	− .283	(.049)	− .273	(.037)	−.308	(.038)
35	− .280	(.109)	− .118	(.046)	− .068	(.034)	−.141	(.036)
40	− .098	(.098)	− .043	(.041)	− .030	(.030)	− .049	(.032)
45	− .005	(.099)	−.028	(.041)	.010	(.031)	−.007	(.032)
50								
55	.001	(.106)	.001	(.044)	−.058	(.034)	− .025	(.034)
60	.119	(.126)	.067	(.052)	−.098	(.038)	.006	(.040)
61	− .013	(.072)	.007	(.069)	− .176	(.052)	− .080	(.054)
62	− .119	(.215)	.071	(.077)	− .133	(.054)	− .059	(.060)
63	− .068	(.262)	.059	(.081)	− .226	(.060)	−.084	(.066)
64	.074	(.311)	.093	(.084)	−.244	(.063)	−.058	(.070)
Shock variables for previous zero.								
1 year earlier	− .941	(.065)	− .707	(.051)	− .709	(.041)	−.831	(.031)
2 years earlier	− .447	(.069)	− .166	(.048)	− .293	(.046)	− .333	(.032)
3 years earlier	− .355	(.073)	− .024	(.047)	− .120	(.040)	−.202	(.033)
4 years earlier	− .282	(.078)	.017	(.048)	− .089	(.040)	−.141	(.034)
5 years earlier	−.168	(.084)	.030	(.049)	− .007	(.041)	− .064	(.035)
Shock variable for zero in following year	−.776	(.056)	−.864	(.049)	−1.039	(.047)	−.827	(.029)
R^2	.114		.225		.325		.169	
Standard error of estimate	.899		.237		.130		.378	
Persons	505		566		505		1,576	
Observations	4,581		6,319		5,847		16,747	

[1] Numbers reported are logarithm of ratio of wage-indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock.

There are a number of aspects of these equations which are interesting to note.[39] Even before consideration of the coefficients, we can examine the numbers of observations per person appearing in each third of the income distribution.[40] In the lower third, there were 9.1 observations per person; in the middle third, 11.2; and in the upper third, 11.6. Thus zeros are more likely to occur for low income persons. Examining the standard error of estimates in the three equations, we see that the higher the income level the lower the error in estimation. There are two obvious sources for this result—that high income people have less individual noise about their trends and that differences in trends are more important for low earners than high earners (e.g., that the lower third contains a greater fraction of irregular workers who don't have typical earnings paths). Both hypotheses seem plausible.

To compare the age structure of earnings by thirds of the income distribution, we can examine Figure 3. The paths, of course, are roughly similar. However, there are two surprises in the diagram, relative to our expectations. First, it is the high earners who have relative earnings declines as they approach retirement age. While this can be thought of as a natural consequence of a higher income elasticity of the demand for leisure at these ages than when younger (which does not seem implausible), it runs counter to the expectation that low earners would experience far more difficulty in maintaining earnings. However, at later ages the difference might be due to a greater tendency to retire (and thus leave the sample) for lower earners experiencing earnings declines than for higher earners with similar experiences. The second surprise occurs in consideration of earnings when workers are in their thirties. High and middle earners approach their lifetime maxima more rapidly than do low earners. Put differently, high and middle earners experience more of their wage growth at younger ages than do low earners. This runs counter to an image of low earners getting close to their peaks at far younger ages than high earners.

Considering the coefficients on the shock variables, past zeros are considerably more important for the lowest earners than for the other two groups. In the absence of data on the reasons for zeros, one can only speculate that this might

[39] By the Chow test, the equations differ significantly from each other at the 1 percent level.

[40] The lower quality of the estimate of a^h when there are fewer observations might tend to move a somewhat higher fraction of those with fewer observations into both upper and lower thirds.

reflect a greater frequency of job shifts out of covered employment for high earners and a greater frequency of moves out of the labor force for low earners, with the implied differences in work experience and health. The coefficient for anticipatory shock gets larger the higher the income level. Given the bias away from zero in that coefficient arising from the taxable maximum, one would have greater bias the higher the income level of the group.

Since the results reported in Appendix A confirm the view that growth paths are similar by income level, except at the bottom, further work in this area might explore a basis for eliminating very low earners from the sample.

8. Residuals

There are a number of questions about the residuals which are of interest. Of course one wants to know their size and pattern, especially since the simulation depends in an important way on the shape of the entire distribution and not simply its variance. Further, one would expect a significant age structure to the residuals. It is interesting to examine autocorrelation in the residuals. Examining residuals separately by person, it is interesting to examine the relationship between the size of residuals and the level of individual constant (i.e., earnings path).

Using the equation with all shock dummies fitted to the 0.1 percent CWHS sample, the residuals were calculated for each year and each person in the small sample and adjusted for degrees of freedom for that person.[41] The residuals were then separated by the age of the person in each year, with all residuals for ages 20–28 pooled to calculate a density function. The same procedure was followed for ages 29–37, 38–46, 47–55, 56–64. The densities were used for the simulation. They are shown in Figure 4. Surprisingly, the estimated distribution of the residuals gets tighter the older the individuals involved. While this is to be expected in moving from the youngest workers, it is surprising to find the distribution continuing to get tighter as one moves to the largest ages considered. Perhaps the latter result is partially a consequence of the elimination of individuals from the sample when they begin receiving retirement benefits since the analysis by income level showed sharply greater variances for low earners than for high earners and retirement at age 62 is disproportionately concentrated among the workers with lowest earnings.

[41] The adjustment made was to multiply each residual by the square root of the ratio of the number of observations for that person to the number minus one.

Fig. 4 Distribution of Random Terms

a. Age: 20-28

Mean of Exp.: 1.243
Prob. ($|x| \leq 1.55$) = .954

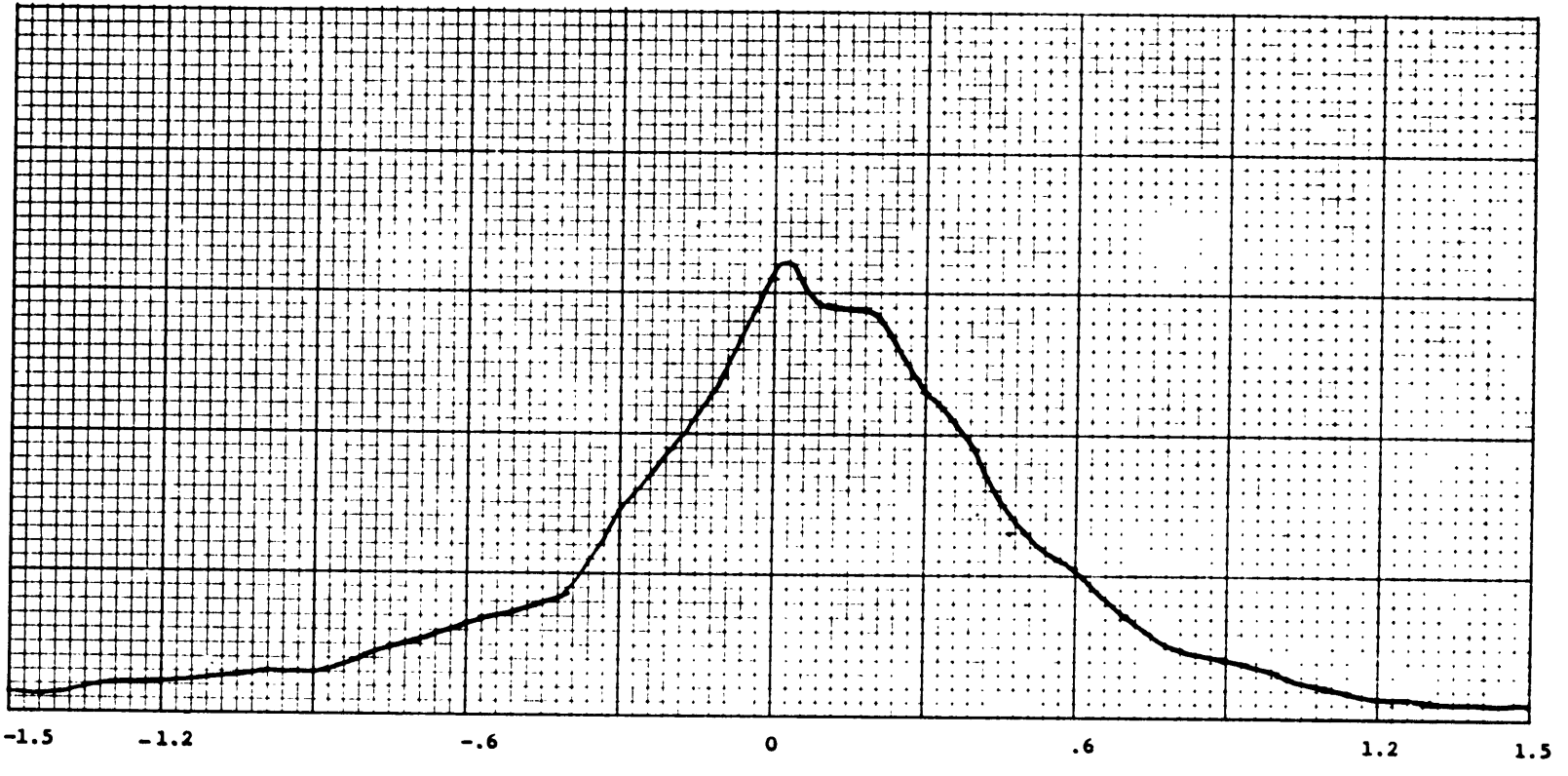


Fig. 4 Distribution of Random Terms (cont'd)

b. Age: 29-37

Mean of Exp.: 1.173
Prob. ($|x| \leq 1.55$) = .963

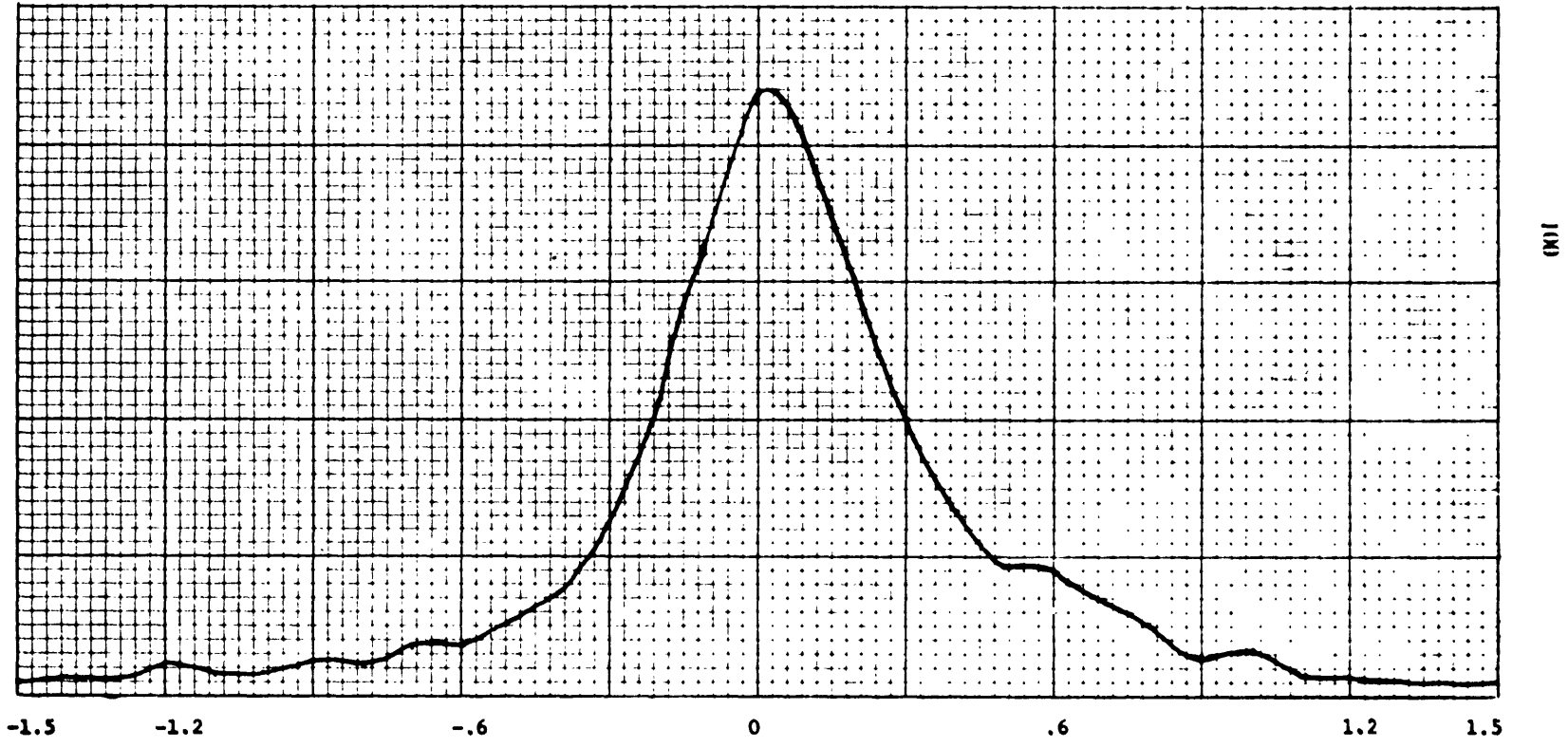


Fig.4 Distribution of Random Terms (cont'd)

c. Age: 38-46

Mean of Exp.: 1.162
Prob. ($|x| \leq 1.55$) = .971

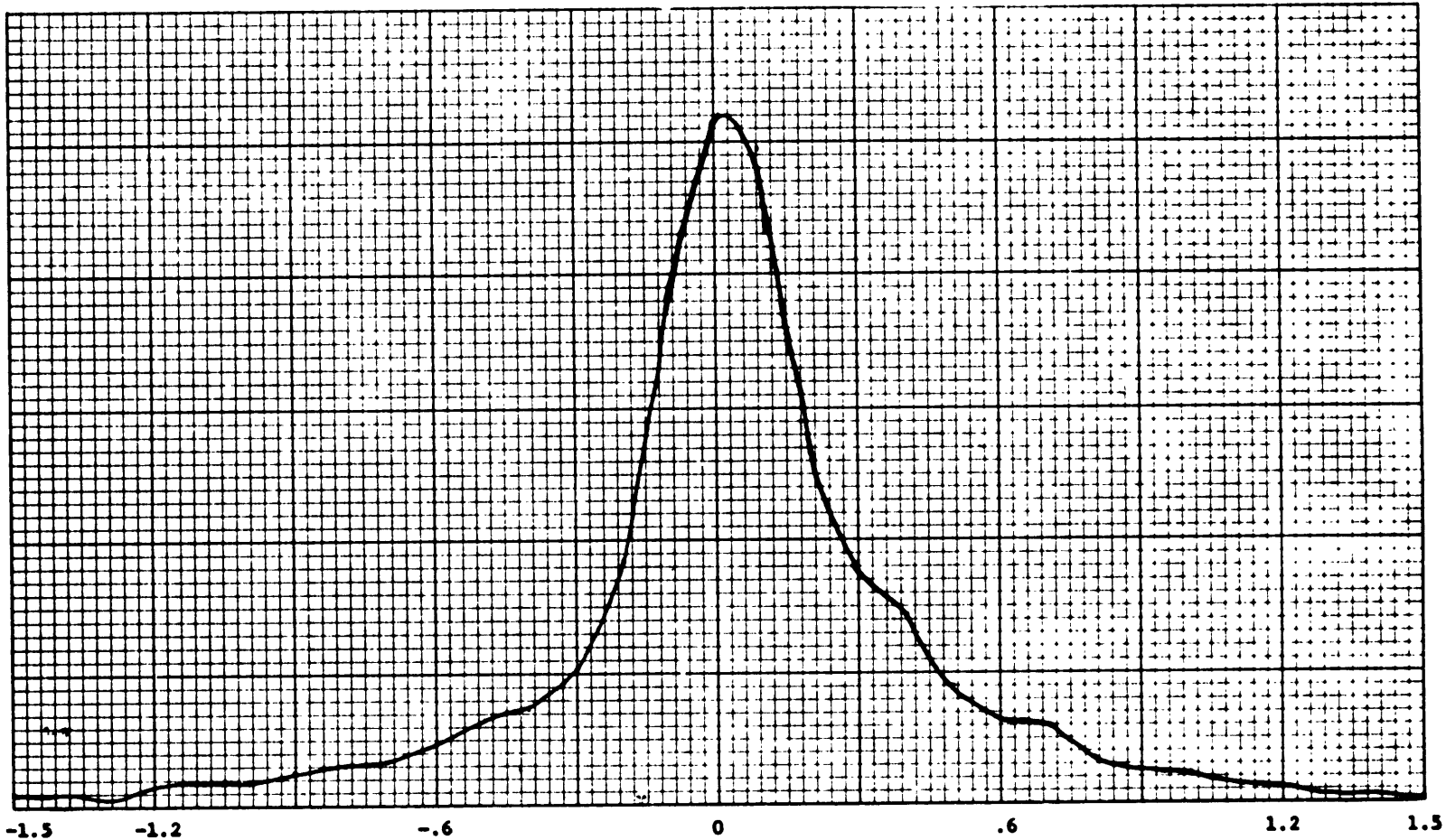


Fig. 4 Distribution of Random Terms (cont'd)

d. Age: 47-55

Mean of Exp.: 1.147
Prob. ($|x| \leq 1.55$) = .976

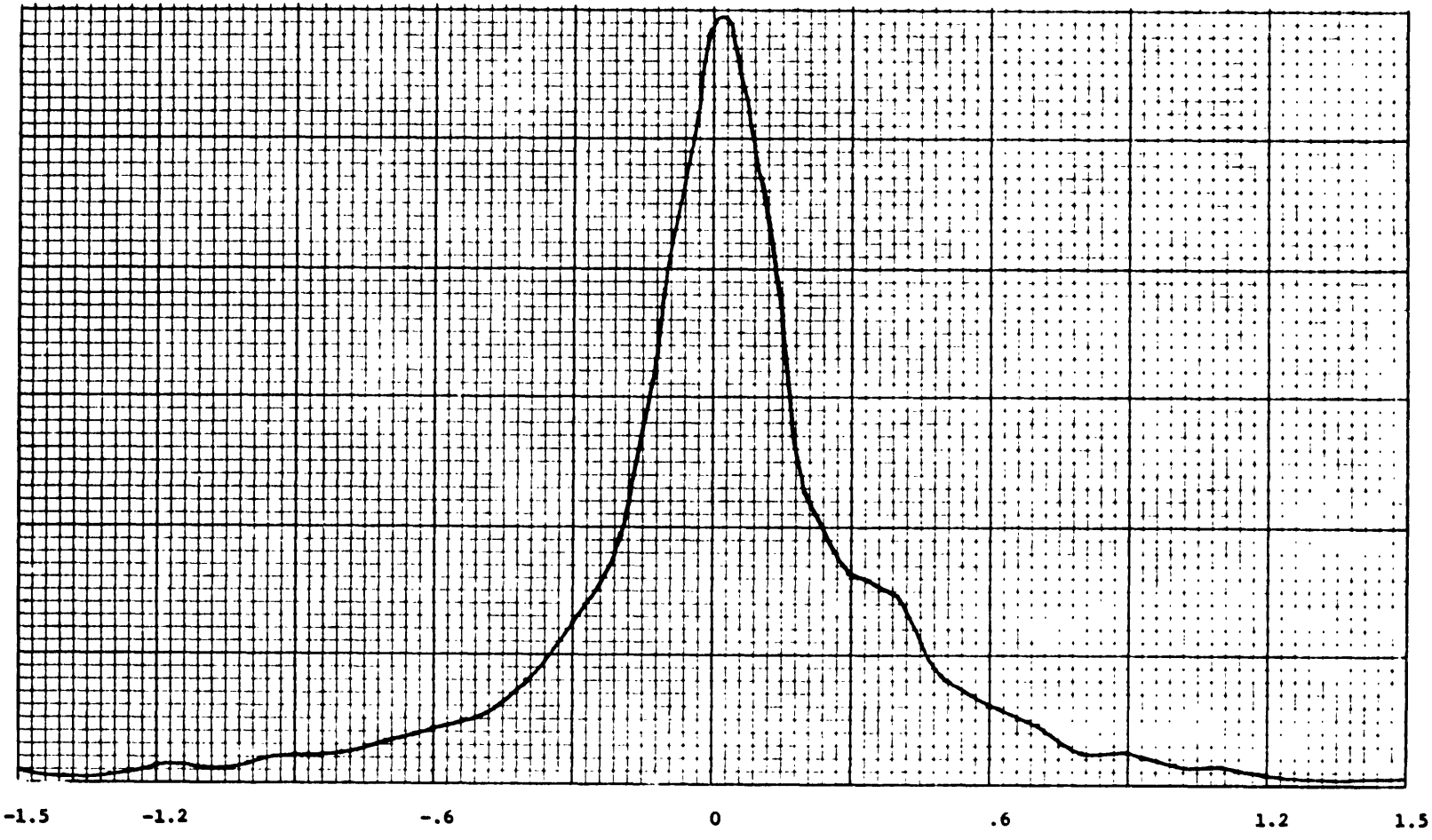
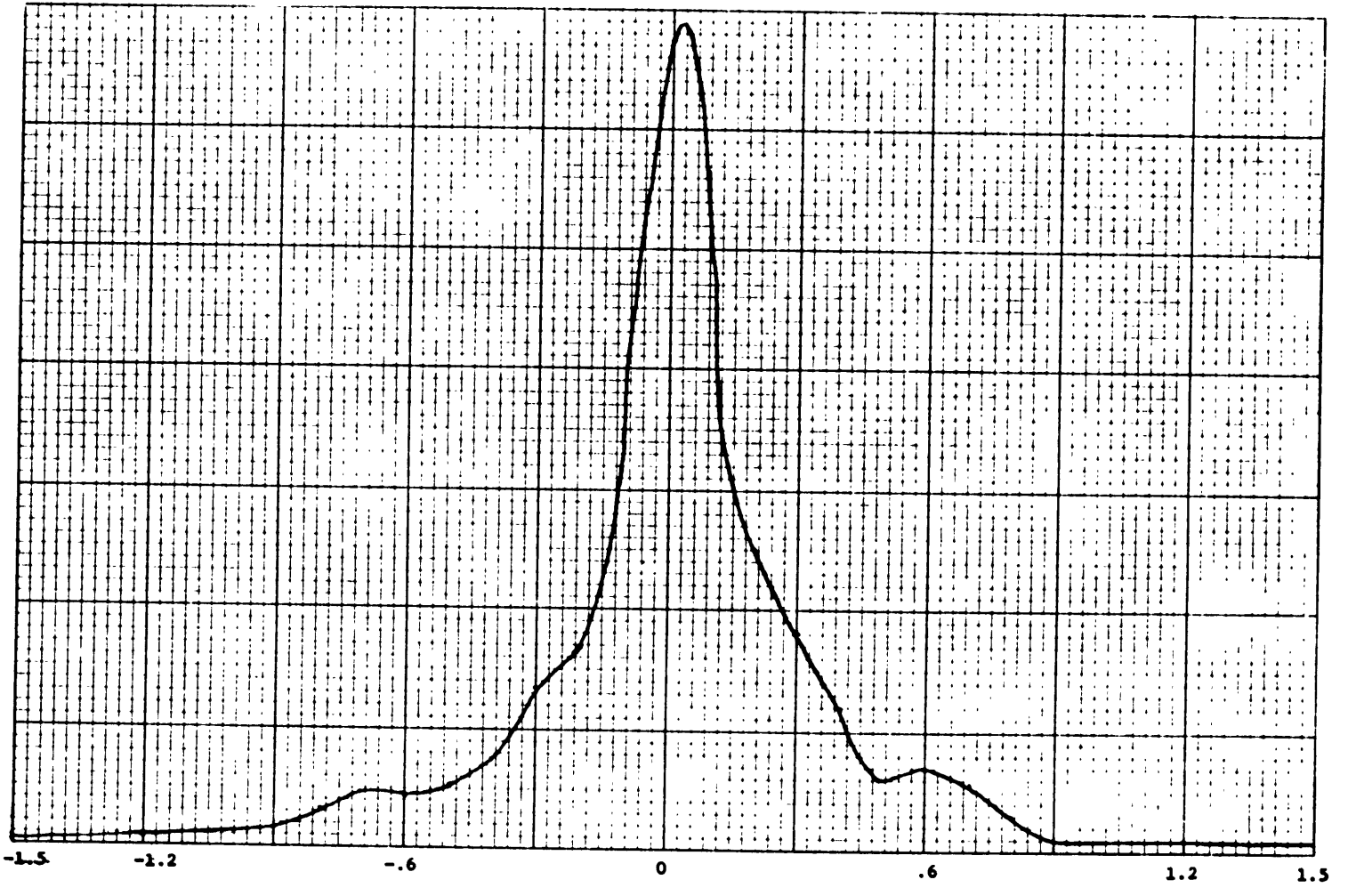


Fig. 4 Distribution of Random Terms (cont'd)

e. Age: 56-64

Mean of Exp.: 1.123
Prob. ($|x| \leq 1.55$) = .983



To explore the age structure in the size of the residuals, the residuals for each person were calculated from the smaller sample using the coefficients from the equation fitted to the 0.1 percent CWHS. Each residual was then corrected for degrees of freedom[42] and squared. Collecting all squared residuals for persons of each age the mean was calculated. The results of this calculation are shown in table 9.

TABLE 9 MEAN SQUARE ERROR BY AGE

(Adjusted for degrees of freedom) Residuals based on coefficients from regression in Table 4 with all variables)

Age	MSE	Age	MSE	Age	MSE
20	0 596	35	440	50	.355
21	577	36	372	51	267
22	506	37	296	52	198
23	489	38	329	53	.277
24	516	39	308	54	337
25	459	40	303	55	260
26	519	41	361	56	324
27	420	42	323	57	301
28	545	43	363	58	256
29	386	44	293	59	189
30	358	45	275	60	239
31	597	46	325	61	252
32	442	47	341	62	188
33	430	48	403	63	130
34	.478	49	298	64	103

Paralleling the picture described above, the errors decline with age, with a sharp drop after 62.

To examine autocorrelation, a data set was made of those residuals (from the equation with all dummies and the small sample) for which a residual was available for the same person in the previous year. Then an ordinary least squares regression was performed, regressing residuals on those for the same person in the previous year.[43] The results are shown in equation (11)

Coefficient: .284 Standard error: .008 (11)

Number of observations: 14,773

The coefficient estimate of 0.28 is biased. Correcting the bias on the assumption of 16 observations per person.[44] the estimated coefficient is 0.4. No use has been made of autocorrelation in the simulations reported here.

In addition to examining the residuals of the entire population, one can examine the estimate of variance separately by person, assuming a constant variance over the observation period.[45] These estimates could be examined in a number of ways (e.g., by date of birth, by number of years of positive earnings). The analysis above by thirds of the income distribution suggested a strong negative correlation between income level and individual variance. Calculating the correlation[46] between these two characteristics, this picture is confirmed, with a coefficient of − 0.47.

[42] Each residual was multiplied by the square root of the ratio of the number of observations for that person to the number minus one.

[43] Two corrections to the data might have been made—to adjust individual observations for the number of observations for that person (and so degrees of freedom) and for the age of the person (and so different variance by age). Neither correction was made. The coefficient is probably not significantly affected by these two factors since they correct independent and dependent variables similarly. Should autocorrelation differ significantly with age, the failure to make any adjustments might be important.

[44] Following the procedure used by Gordon in the Appendix to Chapter III of his Ph.D. dissertation.

[45] These estimates are based on the small sample excluding years before zeros.

[46] In doing this calculation no adjustment was made for the variances in the estimation of α^h and individual variance. A weighted correlation might have been different.

9. Individual trends

Just as the basic model described above in equation (3) contains individual constants for the height of the earnings path, it is natural to consider adding an individual trend to the equation. Then (ignoring zeros) the basic equation would take the form:

$$W_t^h = a^h + \Sigma b_u A_u^h + c^h(\text{Age}_t^h - 50) \qquad (12)$$

where Age_t^h is the age of person h in year t. Considering entire lifetimes rather than 16-year observation periods it is not completely plausible that an individual will have earnings growth that is consistently more rapid than the typical path in his cohort; that is, the validity of extending a 16-year model to 45 years seems lower for a trend term than for an intercept term. Nevertheless, this model was briefly explored, although not used in the simulation.

The following iterative procedure was followed: Regress W_t^h on age and shock dummies, then take the residuals for each person separately and regress them on time. Provided the distributions of the c^h are the same for every cohort,[67] the omitted variables are independent of the included variables in the first regression. Thus the estimates of the coefficients on age and dummies are unbiased and consistent. Regressing the residuals on time for each person provides an asymptotically unbiased estimate of c^h (asymptotic in the number of persons in the first regression). Since age is nonstochastic, had the sample been constructed to include given numbers of each age, the estimates of c^h would be unbiased too.

Following this procedure, of course, gives the same age structure. One can then examine the distribution of c^h by cohort to test the stability of the model and the validity of the procedure. One can also examine the correlation between a^h and c^h to examine whether high income people have high earnings growth. Starting with the latter question the correlation is 0.02, showing a very weak relationship as was suggested by the separate regressions for different income levels. Table 10 contains the mean value of c^h by cohort.[68]

TABLE 10 MEAN INDIVIDUAL RATE OF GROWTH BY COHOPT (c^h)

Date of birth	Mean	Date of birth	Mean	Date of birth	Mean
1894	0 099	1913	021	1932	– 003
1895	020	1914	– 028	1933	– 006
1896	024	1915	– 004	1934	– 017
1897	– 009	1916	053	1935	– 002
1898	085	1917	009	1936	– 015
1899	– 087	1918	008	1937	005
1900	– 033	1919	– 019	1938	025
1901	– 009	1920	052	1939	023
1902	– 025	1921	013	1940	013
1903	– 053	1922	003	1941	048
1904	– 019	1923	041	1942	– 034
1905	– 009	1924	– 013	1943	.036
1906	010	1925	– 001	1944	012
1907	– 032	1926	– 015	1945	– 011
1908	– 037	1927	– 029	1946	066
1909	– 006	1928	– 003	1947	004
1910	024	1929	017	1948	013
1911	– 118	1930	– 020	1949	– 068
1912	– 002	1931	.022		

There is a slight trend apparent in these coefficients.[69] This trend implies that under the assumptions underlying equation (12) the procedure will produce biased estimates of the age structure of earnings.[69] By an F test, the entire set of coefficients was found to be statistically significant at the 1 percent level.

[67] A similar condition must hold for shock dummies.

[68] Again, an unweighted mean was used.

[69] No statistical test has been performed on the significance of this trend.

[69] It is interesting to not that with this further adjustment, a repeat of the autocorrelation regression on these residuals yields a much lower coefficient of 0.06.

10. Unemployment Rates

In considering simple way of extending the model, one that comes immediately to mind is the use of some measure of the business cycle as an independent variable. For simulation purposes use of such a model would require simulating future business cycles. Thus, for simulation purposes the business cycle was left as part of the residual noise, leaving an assumption that future business cycles will have comparable severity to those experienced in the observation period. Nevertheless a little analysis was done to include the business cycle to evaluate the changes in parameters induced in this way.

If the dependent variable were real wages or wages relative to some trend, one would expect an increase in the unemployment rate to lower wages. However the effect of higher unemployment on wage-indexed wages is more complicated. One would expect that part of the effect would be an increase in the variance of residuals. Conventional discussions also suggest that unemployment falls more heavily on the younger and older workers, suggesting that their relative wages would decline with high unemployment, while those of medium age workers would therefore increase. To capture this effect we have defined two unemployment-age variables. Both variables are the national unemployment rate or zero depending on the age of the particular worker:

$$U^{y}_{it} = \begin{cases} U_t & \text{if worker } h \text{ is less than 35 years old in year } t \\ 0 & \text{otherwise} \end{cases} \qquad (13)$$

$$U^{h}_{3t} = \begin{cases} U_t & \text{if worker } h \text{ is greater than 54 years old in } t \\ 0 & \text{otherwise} \end{cases}$$

where U_t is the national unemployment rate for males 20 and over.

In table 11 are reported the results of this regression on the small sample.

TABLE 11 EFFECTS OF UNEMPLOYMENT (16 747 OBSERVATIONS 1 576 PERSONS)

	Wage-indexed earnings [1]	Standard errors
Variables		
Age		
20	- 1 178	(0 057)
25	- 437	(051)
30	- 181	(048)
35	102	(037)
40	- 055	(032)
45	000	(033)
50		
55	- 608	(042)
60	032	(054)
61	- 059	(062)
62	037	(068)
63	- 063	(073)
64	- 037	(077)
Shock variables for previous 6		
1 yr earlier	- 834	(031)
2 yr earlier	- 333	(032)
3 yr earlier	- 203	(032)
4 yr earlier	- 139	(034)
5 yr earlier	- 059	(035)
Shock variable for zero in following year	- 823	(029)
Unemployment- Age interaction		
20 to 34	- 025	(006)
55 to 64	- 006	(009)
R^2	170	
Standard error of estimate	378	. . .

[1] Numbers reported are logarithm of wage indexed earnings at a particular age to earnings at age 50 or ratio of earnings with shock to earnings without shock

The effect of an increase of one point in the unemployment rate is a 2.5 percent decline in earnings of a young worker relative to his earnings if he were age 50. The equation also shows a small decline in earnings for older workers, however the coefficient is not statistically different from zero.

11. Mean Earnings by Age

The basic model we have explored uses longitudinal data to examine the wage paths of individuals relative to movements in an economy-wide average over the same period. Given an age structure which is assumed to hold over long periods, given a stable distribution of individual constants across cohorts, and given the distribution of residuals,[51] the model implies a pattern to the cross-section structure of mean earnings at any time. We have not done the calculations to relate the model to the implied cross-section structure. Nevertheless, for the purposes of this project, it is useful to examine the matrix of mean earnings by age, sex, and year to explore the stability of the cross-section pattern of indexed earnings. Table 12 contains this matrix calculated from the 0.1 percent CWHS, where for each sex the earnings in each year have been deflated by average earnings in that year of those included in the tabulation.[52]

[51] The distribution of the residuals is relevant since the model has a logarithmic form—the expected value of log wages (which equals the coefficients) will be less than the log of the expected value of wages. This will affect the cross-section pattern since the variance in residuals is not constant across ages.

[52] The table reports mean estimated earnings for those between 20 and 65, excluding in a year anyone with zero earnings in that year, anyone who died or received disability benefits in that year or anyone entitled to old age benefits in that year or earlier. The tabulations for males are based on at least 500 observations except for ages in the 60's. The female tabulations have about one half the numbers in the male tabulations. The estimated standard deviation in the estimate of the mean income is generally a few hundred dollars varying across the matrix.

TABLE 12 MEAN EARNINGS BY AGE INDEXED BY MEAN EARNINGS BY SEX

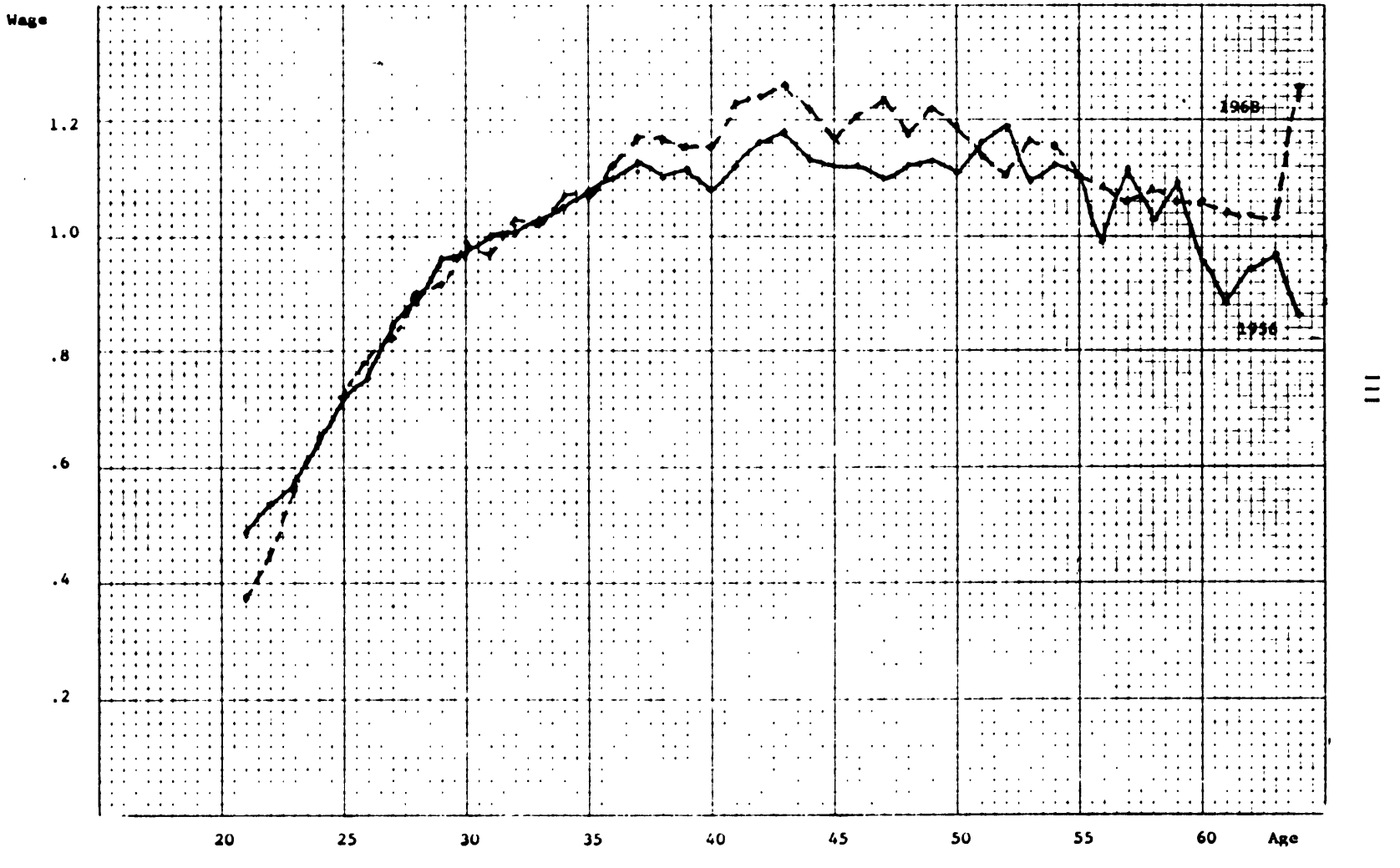
	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Male:																
21	0.4879	0.4467	0.4484	0.4590	0.4486	0.4274	0.4171	0.4182	0.4335	0.4194	0.3317	[illegible]	0.3752	0.3719	0.3761	0.3776
22	.5396	.5357	.4937	.5259	.5222	.4967	.4963	.4909	.4759	.4994	.4918	.4569	.4508	.4587	.4294	.4421
23	.5688	.5521	.5455	.5805	.5873	.5763	.5620	.5816	[illegible]	.5650	.5819	.5723	.5663	.5598	.5484	.5157
24	.6500	.6290	.5936	.6315	.6113	.6283	.6314	.62[illegible]	.6684	.6442	.6631	.6511	.6518	.6567	.6306	.6207
25	.7214	.7670	.6718	.6928	.7061	.6773	.6689	.7034	.6975	.7280	.7094	.7278	.7258	.7167	.7031	.6838
26	.7564	.7843	.7427	.7484	.7737	.7961	.7536	.7407	.7809	.7804	.8176	.7651	.7962	.7847	.7040	.7666
27	.8440	.8321	.8186	.8097	.7939	.8093	.8292	.8140	.8045	.8360	.8195	.8704	.8280	.8535	.8363	.8224
28	.8860	.8867	.8679	.8642	.8560	.8542	.8480	[illegible]	.8740	.8309	.8947	.8611	.9063	.8787	.9032	.8968
29	.9620	.8425	.9381	.9142	.9145	.9022	.8836	.8808	.8996	.9158	.8982	.9467	.9215	.9553	.9042	.9650
30	.9648	.8856	.9637	.9746	.9526	.9330	.9263	.9757	.9264	.9454	.9419	.9456	.9911	.9579	.9962	.9480
31	1.0012	.9942	1.0319	.9958	.9944	.9357	.9895	.9938	[illegible]	.9403	.9530	.9981	.9725	1.0130	1.0118	1.0118
32	1.0072	1.0339	1.0534	1.0235	1.0093	1.0121	1.0139	1.0145	1.0017	.9711	[illegible]	.9988	1.0288	1.0841	1.0757	1.0290
33	1.0331	1.0508	1.0805	1.0535	1.0413	1.0285	1.0270	1.0468	1.0475	1.01[illegible]	.9854	1.0238	1.0243	1.0587	1.0370	1.1119
34	1.0524	1.0647	1.0568	1.0884	1.0526	1.0808	1.0511	1.0681	1.0731	1.1018	1.0605	1.0562	1.0731	1.0674	1.0850	1.0755
35	1.0809	1.0681	1.0944	1.0867	1.1420	1.1039	1.1155	1.0861	1.0923	1.0757	1.1100	1.1096	1.0725	1.094	1.0897	1.1357
36	1.1001	1.1247	1.0731	1.1028	1.0827	1.1199	1.1335	1.1615	1.1110	[illegible]	1.1751	1.1339	1.1215	1.1470	1.1513	1.1123
37	1.1331	1.1094	1.1223	1.0978	1.1033	1.0911	1.1387	1.1500	1.1558	1.1345	1.1145	1.1256	1.1739	1.1350	1.1761	1.1583
38	1.1020	1.1778	1.1267	1.1566	1.1511	1.1294	1.0691	1.1281	1.1686	1.1805	1.1291	1.1325	1.1658	1.1332	1.1735	1.1785
39	1.1157	1.1218	1.1680	1.1169	1.1948	1.1393	1.1217	1.1190	1.2090	1.1649	1.2055	1.1429	1.1558	1.1956	1.1985	1.1866
40	1.0828	1.1479	1.1617	1.1786	1.1255	1.1519	1.1449	1.1249	1.1226	1.2233	1.1664	1.2173	1.1506	1.1669	1.1977	1.2295
41	1.1219	1.1169	1.1335	1.1692	1.1890	1.1521	1.1949	1.1571	1.1908	1.1578	1.2287	1.1868	1.2338	1.1623	1.1698	1.2224
42	1.1632	1.1724	1.1252	1.1433	1.1527	1.1895	1.1535	1.1769	1.1439	1.1715	1.2239	1.2398	1.2395	1.2351	1.21[illegible]7	1.1923
43	1.1803	1.1948	1.1633	1.1256	1.162[illegible]	1.1597	1.1874	1.1687	1.1927	1.18[illegible]	1.1648	1.1946	1.2634	1.2353	1.2555	1.2624
44	1.1624	1.1674	1.1833	1.1769	1.1089	1.1543	1.1488	1.2169	1.1729	1.3142	1.1828	1.1545	1.2084	1.2182	1.2340	1.2656
45	1.1224	1.1396	1.1931	1.1906	1.1727	1.1083	1.1589	1.1137	1.2[illegible]	1.1919	1.2133	1.1819	1.1676	1.2101	1.2787	1.2477
46	1.1236	1.1299	1.1267	1.1835	1.2207	1.1954	1.1157	1.1637	1.1263	1.2225	1.2280	1.2[illegible]	1.2098	1.1792	1.2182	1.2660
47	1.0999	1.1665	1.0944	1.1238	1.1884	1.1747	1.1732	1.11[illegible]	1.1814	1.1981	1.2774	1.2081	1.2354	1.2095	1.2815	1.2284
48	1.1201	1.1346	1.1480	1.1049	1.1037	1.1741	1.1924	1.1344	1.1174	1.1181	1.1942	1.2201	1.1743	1.2390	1.2191	1.1917
49	1.1270	1.1520	1.1294	1.1295	1.1109	1.0846	1.1595	1.2342	1.1745	1.0984	1.1433	1.1800	1.2224	1.2007	1.2384	1.1938
50	1.1110	1.1490	1.1640	1.0976	1.1031	1.1103	1.08[illegible]	1.1539	1.1308	1.1727	1.1792	1.1346	1.1895	1.2307	1.1825	1.2386
51	1.1827	1.0973	1.0967	1.1131	1.1077	1.1820	1.1097	1.0776	1.1722	1.1844	1.1618	1.1058	1.1398	1.1774	1.2369	1.1790
52	1.1912	1.1299	1.1039	1.1184	1.0986	1.1099	1.1483	1.0686	1.0900	1.1387	1.1715	1.1635	1.1091	1.1350	1.1603	1.2547
53	1.0971	1.1629	1.1409	1.0932	1.1303	1.1263	1.2085	1.1388	1.0940	1.0756	1.1271	1.1879	1.1688	1.1245	1.1502	1.1700
54	1.1254	1.8728	1.1525	1.1505	1.0656	1.1170	1.1121	1.0712	1.0865	1.09[illegible]	1.0477	1.13[illegible]	1.1548	1.1581	1.0651	1.1420
55	1.1062	1.0919	1.1135	1.1530	1.1351	1.0488	1.1155	1.0680	[illegible]	1.1097	1.0413	1.0613	1.1092	1.1859	1.1534	1.0655
56	.9935	1.0876	1.1279	1.0965	1.1220	1.1128	1.0276	1.0939	[illegible]	1.0585	1.0564	1.0811	1.0881	1.0938	1.1821	1.1303
57	1.1159	.9872	1.0709	1.8514	1.1091	1.1144	1.1310	1.0731	1.0667	1.0741	1.8267	1.1303	1.0867	1.0464	1.0754	1.1439
58	1.0792	1.0883	1.0092	1.0887	1.0478	1.0792	1.1865	1.8912	1.044	1.0267	1.0839	1.0395	1.0844	1.0510	1.8725	1.9714
59	[illegible]	1.8535	1.0525	.9611	1.0286	1.0818	1.0565	1.1055	1.8505	1.0445	1.0245	1.0445	1.0611	1.0899	1.0340	1.0743
60	.8548	1.1270	1.0004	1.0478	.9752	1.0152	1.0170	1.8725	1.1198	1.0492	.9946	1.0422	1.0504	1.0164	1.0498	.9968
61	.8848	.9416	1.0815	.9815	1.0163	.9587	.9669	.5897	1.0332	[illegible]	.9968	.9954	1.0408	1.0240	.9663	1.0637
62	.9465	.9784	.9477	1.0983	.9728	1.0784	1.8112	1.1826	1.0660	[illegible]	1.1810	1.0815	1.0353	1.1531	1.1505	1.0574
63	.9710	.9382	.9051	.9205	1.0426	1.0879	1.1355	1.1253	1.13[illegible]	1.11[illegible]	1.0476	1.2540	1.0344	1.0257	1.1784	1.1598
64	.8628	.9715	.9459	.9800	.8981	1.1889	1.1647	1.1286	1.1079	1.2061	1.1661	1.1414	1.2599	1.0791	1.2228	1.1972

TABLE 12 — MEAN EARNINGS BY AGE, INDEXED BY MEAN EARNINGS BY SEX- Continued

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Female																
21	7896	7957	7677	7256	7470	7185	7221	7390	7058	7168	7076	6943	7164	6929	6710	6376
22	8510	8244	8516	8422	7905	7961	8044	8060	8180	7935	7995	7694	7819	8020	7805	7641
23	8914	8383	8627	8713	8682	8416	8452	8361	8631	9200	8961	9337	8788	8814	8999	8828
24	9092	9006	8812	8918	9010	8706	8571	8743	8788	8805	9197	9151	9535	9503	9639	9363
25	9171	8665	8704	8881	9188	9220	8909	8795	8891	8508	9090	9596	9534	9191	9404	9405
26	9103	9164	8883	8549	8886	9156	9068	8562	9083	8957	8914	9295	9537	9846	9316	9423
27	9694	9006	8660	8754	8407	8359	9415	9000	8837	9187	9174	8649	9000	9771	9852	9521
28	9323	9169	8843	8940	8988	8520	8625	8814	8835	9144	9451	9285	8936	8900	9356	9897
29	8452	8674	9176	8639	8921	8818	8968	8880	9033	8718	8331	9059	9301	8757	9224	7989
30	9654	8581	9239	9527	9668	8633	8736	8984	8306	9218	8868	8675	9260	8979	8529	9290
31	8757	8634	8593	9195	9010	8963	9197	9141	9093	9084	9554	8304	9267	9763	9462	8978
32	9565	9278	9586	8527	9321	8757	8510	8964	8908	8982	9129	9741	8556	9243	9619	9300
33	9753	9421	9036	9977	8651	9404	9119	8773	8695	9661	8702	9147	9868	8777	9281	9332
34	8888	9743	9701	9181	1 0044	8890	9527	9410	9033	8819	9080	9184	9429	9960	9106	9320
35	1 0168	8823	9306	9459	9516	9850	9698	9566	8983	9061	9272	9295	9258	9797	9944	9127
36	9675	1 0183	9099	9764	9796	1 0171	9881	9486	1 0140	9151	9314	8984	9249	9177	9520	1 0366
37	9848	9686	1 0246	9109	9590	1 0116	1 0239	1 0177	9849	9934	9732	9151	9144	9543	8961	9530
38	1 0787	9980	9470	1 0432	9072	9683	1 0654	9805	1 0179	9837	1 0073	9485	9459	9706	9745	9739
39	1 0000	1 0682	1 0101	9441	1 0229	9867	9514	1 0045	1 0004	1 0287	9964	1 0272	9993	9880	9713	9829
40	1 0021	1 0079	1 0829	1 0159	9951	1 0134	9769	9988	1 0132	1 0209	1 0238	9925	1 0414	9877	9997	1 0875
41	9974	1 0410	1 0598	1 0901	1 0737	1 0326	1 0200	9976	9885	1 014	1 0061	1 0059	1 0047	1 0659	9987	1 0276
42	1 1007	1 0141	1 0598	1 0000	1 0603	1 0510	1 0156	1 0450	1 0247	9996	1 0453	1 0559	1 0696	1 0043	1 0692	1 0422
43	1 0509	1 0984	1 0193	1 0759	1 0533	1 0895	1 0531	1 1317	1 0381	9893	1 0413	1 0840	1 0755	1 0746	1 0030	1 0668
44	1 0656	1 0460	1 1267	1 0109	1 0475	1 1127	1 0953	1 0817	1 0437	1 0470	1 0318	1 0743	1 0647	1 0729	1 0719	9975
45	1 0855	1 0883	1 0920	1 1000	1 0524	1 0318	1 0852	1 0501	1 0593	1 0742	1 0741	1 0469	1 0643	1 0963	1 1199	
46	1 0756	1 1355	1 0949	1 0932	1 0848	1 0783	1 0650	1 0719	1 0891	1 1079	1 0885	1 0879	1 0235	1 0897	1 0580	1 1694
47	1 0992	1 1409	1 1311	1 0850	1 0684	1 0908	1 0247	1 0967	1 1135	1 1067	1 0825	1 0974	1 0858	1 0451	1 0899	1 0893
48	1 0908	1 0737	1 1311	1 1423	1 0838	1 0883	1 0902	1 0831	1 0800	1 1	1 1214	1 0984	1 1103	1 1286	1 0895	1 0740
49	1 0672	1 0969	1 1007	1 1197	1 1735	1 0865	1 0795	1 1098	1 0852	1 0992	1 1155	1 1217	1 1194	1 1271	1 1135	1 1014
50	1 1427	1 1093	1 0984	1 0955	1 1167	1 1431	1 0848	1 0848	1 0901	1 0853	1 1074	1 1174	1 1294	1 1471	1 1023	1 1152
51	1 0740	1 1316	1 1829	1 0900	1 0701	1 1058	1 1866	1 1063	1 0586	1 0384	1 0476	1 0938	1 0776	1 1474	1 1294	1 1199
52	1 0771	1 0455	1 1388	1 1887	1 0479	1 1106	1 1363	1 1788	1 1372	1 1117	1 0865	1 0669	1 1147	1 1234	1 1820	1 1109
53	1 1317	1 0396	1 0684	1 2451	1 1625	1 0596	1 0877	1 1458	1 1778	1 1148	1 1200	1 0777	1 0724	1 1489	1 1347	1 1779
54	1 1301	1 0999	1 0882	1 0873	1 2623	1 1508	1 0478	1 0854	1 1431	1 1480	1 1193	1 0931	1 1095	1 0874	1 1318	1 1335
55	1 1957	1 1588	1 1359	1 0713	1 1012	1 2545	1 1555	1 0883	1 0697	1 1422	1 1767	1 1250	1 0785	1 1351	1 0993	1 1415
56	1 0435	1 2155	1 1834	1 1237	1 0808	1 0835	1 2026	1 1771	1 1398	1 1794	1 1718	1 1571	1 1491	1 1293	1 1345	1 1137
57	1 0950	9980	1 1860	1 1928	1 1198	1 1195	1 1107	1 2104	1 2029	1 1029	1 0978	1 1702	1 1957	1 1049	1 1396	1 1084
58	1 3832	1 1034	1 0251	1 2037	1 1580	1 1063	1 0943	1 1422	1 2167	1 2009	1 1104	1 1282	1 1505	1 1815	1 1248	1 0916
59	9781	1 0529	1 0405	1 0500	1 2175	1 1521	1 0807	1 0741	1 1504	1 2199	1 2050	1 1878	1 1491	1 1471	1 2169	1 1856
60	1 0519	9387	1 0501	1 0373	1 0817	1 1508	1 1350	1 0990	1 0483	1 1113	1 1052	1 2540	1 1494	1 1047	1 1475	1 1937
61	9822	1 1236	9528	1 0095	1 0346	1 1015	1 1266	1 1431	1 1323	1 0993	1 1713	1 2270	1 1566	1 1043	1 1020	1 1262
62	1 2046	1 1192	1 1113	1 0955	1 2277	1 2513	1 2902	1 2610	1 3178	1 3005	1 1470	1 3914	1 3518	1 2815	1 2568	1 2156
63	1 1868	1 2043	1 0853	1 1360	1 3305	1 1787	1 2470	1 2735	1 2856	1 4218	1 2309	1 2155	1 2887	1 3251	1 3720	1 2509
64	3722	1 3051	1 2511	1 1623	1 2224	1 2037	1 2715	1 2181	1 3151	1 4635	1 4351	1 3339	1 2730	1 2854	1 3374	1 2793

From the perspective of the possible use of wage indexed earnings for benefit calculations, there are three implications of this table worth noting. The large difference in mean earnings between men and women implies that the wage index depends upon the sex mix of the labor force. Over the time period examined the ratio of mean male earnings to mean earnings (both sexes) has varied over a range of 5 percent. Continued growth of female labor force participation rates will see further changes in this ratio. Second, the large differences in mean earnings by age implies that a change in the age structure of the labor force will change the mean wage-indexed wage by age even if the cross-section pattern is unchanged. Third, a change in the mix of experienced and inexperienced workers might alter the age structure of mean earnings. To show these latter two effects, the mean wage by age for male, indexed by mean male wage, is plotted in Figure 5 for 1956 and 1968. The differences are

Fig. 5 Mean Wage-Indexed Wage by Age, Male, 1956 and 1968



noticeable, although not extremely large. The greater fraction of young workers at the later date lowers the mean wage in the economy and so tends to raise the means for each age.

12. Probability of Zero Earnings

The model described above predicts earnings conditional on their being positive.[53] It makes no prediction of whether earnings will be positive and it uses the presence of past and future zeros as part of the prediction process. Thus for simulation purposes, it is necessary to have some model of the probability of zero earnings. The time limitation on this panel, and the effort that went into the model described above, precluded development of anything complicated. Thus a simple Markov model was used despite some evidence that a Markov model did not fit the data very well.[54, 55]

Table 13 contains the data by age bracket of the numbers of males with positive earnings in a year moving to zero earnings in the following year.

Table 14 Contains the same information for the movement from zero to positive earnings.

[53] The presence of zeros is common in the economy. For example, of the 188 persons in the 1926–31 cohorts included in the analysis only 108 (57 percent) had 16 positive observations. Another 24 (13 percent) had 15 positive observations.

[54] See H. Grundmann, A Probability Model to Explain Movements In and Out of OASDI-covered Employment A Progress Report, March 22, 1973. In addition to examining a simple Markov model, this paper considers a latent Markov model.

[55] No examination was made of whether low earnigs relative to individual trend significantly increases the probability of a move out of covered employment Such a finding would imply biased coefficient estimates since the residuals are autocorrelated and the shock dummies would depend on lagged endogenous variables. Roger Gordon has found that the effect of wage level on the movement out of the labor force is very small.

[56] This date was chosen since there was a large change in coverage in 1955 and a small change in 1956

TABLE 13.—NUMBERS MOVING FROM POSITIVE EARNINGS IN A YEAR TO ZERO EARNINGS THE FOLLOWING YEAR

Date	Age 20 to 24		25 to 29		30 to 34		35 to 39		40 to 44		45 to 49		50 to 54		55		56 to 61		62		63		64	
	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]	R[1]	N[2]
1951	664	3 456	204	4, 292	161	4 028	130	3 434	93	2 681	68	2 066	61	1, 436	6	258	31	944	5	87	1	73	3	71
1952	546	3 206	183	4 428	148	4 243	114	3 586	74	2 820	76	2 213	67	1 591	9	216	42	1 111	3	114	4	91	5	74
1953	654	3 223	270	4, 486	176	4 256	157	3 803	116	3 028	113	2 372	75	1 703	10	273	61	1 201	10	138	4	120	4	89
1954	362	3, 192	160	4 277	126	4 361	96	3 844	71	3 161	78	2 502	43	1 758	10	311	38	1, 321	3	118	8	131	9	118
1955	326	3 731	192	4 516	148	4, 650	135	4 209	110	3 596	85	2 858	66	2 130	10	306	60	1 621	6	208	5	149	4	148
1956	143	3, 993	135	4, 501	122	4, 778	126	4 442	116	3 820	103	3 033	59	2 344	14	409	59	1 783	4	209	7	218	12	152
1957	206	4, 949	176	4 869	157	5, 024	141	4, 812	111	4 039	99	3 186	78	2 500	17	415	59	1 946	13	256	11	212	10	218
1958	152	4, 966	147	4, 777	148	5 103	112	4 760	107	4 219	81	3 340	72	2 625	11	437	83	2 070	8	298	9	246	10	205
1959	179	5, 113	158	4, 859	119	4, 993	117	4 949	103	4 302	91	3 520	92	2 805	9	436	88	2 222	8	259	12	295	26	247
1960	185	5, 260	192	4, 908	134	4, 971	147	5 020	125	4 461	111	3 721	87	2 934	11	505	79	2, 342	21	300	16	256	22	284
1961	171	5 327	120	4 940	140	4 898	143	5 024	128	4 606	109	3 880	91	3 01[illegible]	16	556	77	2 514	20	327	19	285	27	244
1962	204	5, 752	153	4, 995	150	4, 893	147	5 002	125	4 778	113	4 015	94	3 16[illegible]	13	552	82	2 753	25	321	27	312	32	279
1963	175	6 031	129	5, 135	121	4 827	104	5 072	113	4 751	114	4 223	79	3 311	19	572	104	2 919	27	393	20	301	34	300
1964	178	6 373	140	5, 296	107	4 893	102	4 989	99	4 918	126	4 293	95	3 518	14	608	84	3 065	29	397	42	374	35	295
1965	171	6, 584	118	5 456	105	4 964	100	4 994	121	5 029	101	4 441	82	3 704	17	646	89	3 282	30	425	24	381	34	348
1966	209	7, 110	163	5, 527	135	5, 118	126	4 967	136	5 069	100	4 625	127	3 914	10	645	118	3 483	32	440	23	408	40	369
1967	218	7 385	168	5 935	96	5, 092	127	4 946	122	5 029	111	4 809	106	3 983	26	725	115	3 598	38	492	47	418	47	398
1968	251	7 664	157	6 252	133	5, 233	108	4, 896	137	5 146	112	4 765	100	4 183	15	722	108	3 715	48	544	44	465	38	378
1969	284	7 927	241	6, 565	152	5, 341	135	4, 921	132	5 005	150	4 915	119	4 261	27	770	141	3 890	53	533	56	514	52	434
1970	407	8 206	303	6 634	189	5 411	158	4 920	163	4 940	195	4 919	165	4 367	29	808	189	4 025	65	551	54	485	75	469
1971	342	8 115	282	6 937	194	5 399	189	4 944	180	4 802	200	4 852	187	4 431	44	798	247	4 152	59	560	73	493	65	441
Subtotal 1957–71	3, 333	96 757	2 647	83 085	2 080	76, 160	1 956	74 216	1, 893	71, 094	1, 813	63 504	1 574	52, 712	273	9 190	1, 665	45 967						
Subtotal ratio (percent)	3 4		3 1		2 7		2 6		2 7		2 9		3 4		3 0		3 6							

[1] Number moving to zero earnings in following year
[2] Number with positive earnings in given year by age in that year

Note. The table is constructed for males who survived to 1972. All those uninsured, entitled to disability benefits in this period or with average earnings per year employed below $500 (during the ages included in the table) were eliminated from the sample of the 0 1 percent CWHS with which the calculations were done

Given the change in eligibility at age 62, no subtotals were calculated for greater ages. Age 61 should have been excluded also, but wasn't

TABLE 14 NUMBERS MOVING FROM ZERO EARNINGS IN A YEAR TO POSITIVE EARNINGS THE FOLLOWING YEAR Continued

Date	Age 20 to 24		25 to 29		30 to 34		35 to 39		40 to 44		45 to 49		50 to 54		55		56 to 61		62		63		64	
	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]	N[1]	N[2]
1951	508	1 307	235	816	170	727	128	563	104	381	59	281	65	198	9	37	43	139	4	12	1	9	2	5
1952	625	1 559	227	811	180	742	138	572	108	419	66	311	52	235	9	39	35	153	2	18	2	13	2	9
1953	597	1 543	204	800	139	721	106	599	94	409	63	325	46	264	6	47	22	183	1	16	2	14	3	15
1954	850	1 645	382	882	303	819	265	674	229	471	158	364	139	309	21	44	105	241	14	29	10	25	9	16
1955	565	1 237	283	703	223	653	189	544	123	331	127	[illegible]	97	234	24	47	71	188	7	22	4	18	7	23
1956	950	1 084	487	669	345	525	261	505	178	371	85	[illegible]	57	232	17	41	52	185	5	25	6	21	3	19
1957	135	245	118	337	103	352	105	377	85	[illegible]	76	270	58	[illegible]	14	38	57	196	3	34	2	24	3	22
1958	185	331	165	380	138	409	123	395	91	[illegible]	82	288	73	258	13	46	57	235	5	29	8	44	6	33
1959	162	299	147	359	126	388	119	404	111	394	95	299	74	289	12	51	59	247	4	31	1	32	3	45
1960	175	323	134	353	120	377	117	404	95	393	76	305	73	309	9	53	72	287	5	42	4	35	3	43
1961	186	335	152	409	123	381	132	422	107	431	125	377	68	317	14	64	72	300	5	46	11	57	8	47
1962	188	327	144	374	92	381	107	413	123	463	95	365	79	338	15	69	83	327	3	45	11	61	10	65
1963	215	377	137	366	121	420	139	490	103	457	101	401	96	358	17	73	69	329	7	65	13	67	6	77
1964	194	352	131	334	127	420	125	438	147	486	122	444	83	338	21	68	93	367	12	65	15	85	6	74
1965	198	339	131	331	143	403	128	408	113	446	112	449	104	352	19	66	75	352	11	62	12	82	11	112
1966	163	317	120	328	93	356	109	367	109	418	92	446	91	372	10	52	79	374	8	56	13	81	11	94
1967	205	362	139	393	110	387	113	381	117	449	81	459	86	412	10	68	66	391	10	74	6	80	13	91
1968	195	357	140	413	98	371	97	430	100	447	94	465	81	453	19	90	90	437	18	87	13	102	13	121
1969	229	416	138	474	88	394	90	414	93	445	88	506	68	475	18	83	68	448	5	93	11	117	14	133
1970	208	438	147	515	113	479	96	487	81	476	81	556	84	543	20	101	77	517	7	98	10	141	13	167
1971	300	559	242	718	161	551	135	561	105	536	127	637	122	644	15	121	111	626	12	113	21	156	18	185
Subtotal 1956 71	3 238	5 377	2 185	6 019	1 756	6 069	1 735	6 401	1 581	6 490	1 447	6 257	1 242	5 709	228	1 038	1 128	5 386						
Subtotal ratio (percent)	60 2		36 3		28 9		27 1		24 3		23 1		21 8		22 0		20 9						....	

[1] Number moving to positive earnings in the following year
[2] Number with zero earnings in a year

Note The table is constructed for males who survived to 1972 All those uninsured entitled to disability benefits in this period or with average earnings per year employed below $500 (during the ages included in the table) were eliminated from the sample of the 0 1 percent OWHS with which the calculations were done Given the change in eligibility at age 62, no subtotals were calculated for greater ages

For use in the simulation model, the subtotals since 1957 were calculated to provide an estimate of the probability of movement.[86] With the change in availability of early retirement for 62–64 year old males, no subtotals were calculated for those ages.

As one would expect, the probability of moving to a zero is u-shaped, troughing in the ages 30–44. The range of probabilities varies very little, being around 3 percent. The probability of movement from a zero to positive earnings is very high for the youngest group and then declines. For those over 30, the probability lies between 20 and 30 percent. Thus the movement probability estimates roughly parallel the relationship between covered and uncovered employment, with roughly 90 percent of employment covered by OASDI.

While no detailed analysis of these probability numbers was employed, a quick examination was made of the explanation of these numbers by means of both the linear and logit probability models, using as explanatory variables time and the unemployment rate. The results were similar for different ages and those for ages 40–49 are reported in table 15.

TABLE 15 MOVEMENTS IN AND OUT OF COVERED EMPLOYMENT

Age	Constant	Time	Unemployment rate
Probability of movement to zero earnings			
Linear model			
40 to 44	0 0012	0 0008	0 0029
Standard error	(0056)	(0002)	(0007)
45 to 49	0178	0013	0051
Standard error	(0039)	(0001)	(0005)
Logistic model			
40 to 44	−4 5429	0317	1071
Standard error	(1888)	(0067)	(0252)
45 to 49	−4 9588	0421	1773
Standard error	(1264)	(0044)	(0173)
Probability of movement from zero earnings			
Linear model			
40 to 44	4401	− 0081	− 0178
Standard error	(0410)	(0015)	(0056)
45 to 49	4081	− 0111	− 0028
Standard error	(0554)	(0021)	(0076)
Logistic model			
40 to 44	0097	− 0465	− 1046
Standard error	(2447)	(0091)	(0324)
45 to 49	− 1393	− 0831	− 0287
Standard error	(3543)	(0128)	(0478)

There is a small positive time trend in the probability of moving to zero over the 15 years in the sample, with an increase of approximately one percentage point in the probability of movement per decade. The unemployment rate enters with a positive coefficient (as one would expect), with a one point rise in the unemployment rate increasing the probability of movement by approximately one-half of one percentage point. For the movement from zero, both the time trend and unemployment rate enter with negative signs. The probability of switching to positive earnings decreases by approximately 1 percentage point per year and by approximately 1.5 percentage points for each one point rise in the unemployment rate.[87]

13. Simulation

The empirical analysis described above has been used as the basis of a stochastic simulation model to examine the effects of economic growth and the lengthening averaging period on the cost estimates. One step in the cost estimation procedure used by the Office of the Actuary employs a set of ratios of the average PIA for newly retired workers in the future to the average PIA for newly retired workers in the base year. The focus of the simulation was to produce this set of ratios under alternative economic assumptions. Of course

[87] The results from the linear and logit models are very similar within the estimation period. One would not want to simply extrapolate these time trends far into the future. Doing so, the two models do give different predictions.

this procedure uses a stochastic description of the past as well as a stochastic description of the future, so would be inappropriate for short-term cost estimation.[58]

The first step in the procedure is to select an age profile of wage indexed earnings for a typical worker, assumed to hold for all cohorts.[59] The profile selected is shown in table 16.

This profile can be combined with any assumed growth in real earnings relative to the wage-index used in the estimation to produce a profile of real earnings.[60] Successive cohorts of 20-year-olds are assumed to have initial real wages which grow at the same rate as the growth in national average real wages. The second step in the procedure is to select the distribution of random elements underlying the generation of wage histories.[61] For this purpose, residuals from the equation based on the 0.1 percent CWHS applied to the small sample of workers were used. Each residual was adjusted for degrees of freedom.[62] All residuals associated with individuals in 9 year age brackets were pooled to form a distribution. These are the distributions shown in Figure 4, above. Given this random structure and the wage profile, 100 wage histories are randomly generated.

Using the transition probabilities shown in table 16, these wage histories are then subjected to probabilities of having zero covered earnings. When a zero occurs, the particular earnings level is set to zero and the neighboring earnings levels are reduced by the factors shown in table 16. This gives the wage histories to be used in calculating benefits.

TABLE 16.--VALUES USED IN SIMULATION

1. Ratio of wage-indexed earnings to those at age 50										
Age	20	25	30	35	40	45	50	55	60	65
Ratio	0.27	0.59	0.78	0.89	0.96	0.99	1.0	0.98	0.95	0.93
2. Probability of zero earnings at age 20										0.1
Probability of zero-earnings in t given positive earnings in t-1										.03
Probability of zero earnings in t given zero earnings in t-1										
Age 20 to 24										0.40
Age 25 to 64										.75
3. Earnings as a fraction of earnings with no neighboring zeros as a consequence of a zero at t										
t-1				0.50	t+3					.85
t				0	t+4					.90
t+1				.50	t+5					.95
t+2				.80						

Only 1 adjustment (the largest decline) was made for any year

It is assumed that at each income level the random pattern of earnings is the same. Thus each of the 100 patterns generated above is assumed to occur at each of 12 earnings levels (corresponding to different individual constants in the regression model). The distribution of individual constants was generated in the regression model and will be used to take a weighted average of PIA, after their computation. However, one further step is needed, the calibration of the distribution of constants to produce the mean estimated covered earnings in the economy. Based on the table of mean earnings by age given above, it was assumed that the mean for 50 year olds was 115 percent of the mean for all males. Then the mean earnings for 50 year olds in 1975 was set equal to $8,939, an estimate of the desired number. This calibration corrects for the difference in wage indexes, the effects of zeros, the distribution of individual constants, and the fact that the error distribution gives a zero expectation for the log wage.

[58] In addition to treating business cycles as part of the residual, no adjustment was made for the greater prevalence of years with no covered employment before 1955. A correction for that could be incorporated in the procedure in a straightforward manner.

[59] The simulation follows the current procedure of estimating PIA assuming all workers retire at 65.

[60] Or it can be combined with any growth of a wage index (relative to the index used in estimation) to produce a profile of wage indexed earnings.

[61] No adjustment has been made for autocorrelation of residuals in the results reported here, although incorporation of autocorrelation would be straightforward.

[62] The adjustment was to multiply each residual by the square root of the ratio of the number of observations for that person to the number minus one.

Using the growth of initial wages for 20 year olds each of the 1200 histories was shifted to give lifetime patterns for different retirement years.[65] For each year, each of the constructed 1200 wage histories in then converted to taxable earnings histories by applying the appropriate taxable maximum. Then, AIME is calculated for each simulated worker and, using the benefit formula, PIA is calculated for each worker.[66] The PIA's for different income levels were weighted to reproduce the distribution of a^h approximately described above in Figure 2[67] and an average PIA calculated. The average PIA's were divided by that of 1975 to get the ratios. Table 17 shows the resulting calculation for 2 percent real growth and the benefit formula recommended above.

TABLE 17

[Ratio of PIA(T) to PIA(1975) all measured in 1975 dollars, price index AIME 2 percent real growth 1975 dollars benefit 80 percent of 1st 2,400, 35 percent of next 4,800, 25 percent of excess]

Year	Amount	Year	Amount	Year	Amount	Year	Amount
1975	1 00000	1976	1 02321	1977	1 04584	1978	1 06802
1979	1 07433	1980	1 08062	1981	1 08689	1982	1 09313
1983	1 09933	1984	1 10549	1985	1 11159	1986	1 11766
1987	1 12252	1988	1 12738	1989	1 13221	1990	1 13703
1991	1 14185	1992	1 14666	1993	1 15145	1994	1 15624
1995	1 17402	1996	1 19160	1997	1 20927	1998	1 22678
1999	1 24412	2000	1 26134	2001	1 27843	2002	1 29539
2003	1 31224	2004	1 32901	2005	1 34565	2006	1 36540
2007	1 38504	2008	1 40458	2009	1 42405	2010	1 44344
2011	1 46274	2012	1 48197	2013	1 50113	2014	1 52023
2015	1 53925	2016	1 55823	2017	1 57714	2018	1 59599
2019	1 61480	2020	1 63356	2021	1 65488	2022	1 67657
2023	1 69864	2024	1 72112	2025	1 74400	2026	1 76733
2027	1 79108	2028	1 81528	2029	1 83991	2030	1 86501
2031	1 89058	2032	1 91664	2033	1 94319	2034	1 97027
2035	1 99787	2036	2 02599	2037	2 05465	2038	2 08389
2039	2 11370	2040	2 14411	2041	2 17511	2042	2 20671
2043	2 23892	2044	2 27177	2045	2 30526	2046	2 33939
2047	2 37417	2048	2 40962	2049	2 44575	2050	2 48255

To examine the sensitivity of the calculation to some changes, the calculation was repeated without probabilities of zero earnings. This produced PIA ratios differing by less than 2 percent and, on average, by considerably less. Decreasing the residuals used in the stochastic simulation by dividing all of them by 1.05 produces no noticeable change.[68] Shifting the distribution of individual constants up or down by 10 percent produces only small changes, on the order of 1 percent. The calculations were repeated for 1 5 percent real growth and for 2 percent real growth until 1971 and 1.5 percent thereafter. These calculations are shown in tables 18 and 19.

[65] The calculation was done separately for years with turning points in the application of the averaging procedure. Linear interpolation of AIME was used for intervening years.

[66] The AIME's generated can be used to examine the importance of the lengthening averaging period. The model shows considerably greater declines in AIME than would be predicted from the same age profile in the absence of random elements in the model.

[67] For simulation purposes, the 32 estimates of a^h based on fewer than 10 observations were removed from the distribution, leaving 156 values.

[68] Previous calculations with a normal distribution of errors, rather than the one generated by the regression model, produced sizeable differences in the estimated effect of lengthening the averaging period.

TABLE 18

[Ratio of PIA(T) to PIA (1975) all measured in 1975 dollars Price index AIME 1 5 percent real growth 1975 dollars benefit 80 percent of 1st 2,400, 35 percent of next 4,800, 25 percent of excess]

Year	Amount	Year	Amount	Year	Amount	Year	Amount
1975	1 00000	1976	1 02055	1977	1 04067	1978	1 06045
1979	1 08461	1980	1 06874	1981	1 07286	1982	1 07695
1983	1 08102	1984	1 08507	1985	1 08911	1986	1 09311
1987	1 09549	1988	1 09784	1989	1 10019	1990	1 10254
1991	1 10488	1992	1 10721	1993	1 10953	1994	1 11185
1995	1 12578	1996	1 13957	1997	1 15248	1998	1 16530
1999	1 17806	2000	1 19072	2001	1 20330	2002	1 21580
2003	1 22823	2004	1 24060	2005	1 25288	2006	1 26634
2007	1 27973	2008	1 29305	2009	1 30629	2010	1 31945
2011	1 33255	2012	1 34562	2013	1 35864	2014	1 37163
2015	1 38459	2016	1 39751	2017	1 41039	2018	1 42323
2019	1 43604	2020	1 44882	2021	1. 46720	2022	1 48590
2023	1 50490	2024	1 52421	2025	1. 54386	2026	1 56384
2027	1 58417	2028	1 60485	2029	1 62588	2030	1 64731
2031	1 66914	2032	1 69137	2033	1 71402	2034	1 73708
2035	1 76056	2036	1 78449	2037	1 80886	2038	1 83369
2039	1 85899	2040	1 88479	2041	1 91108	2042	1 93787
2043	1 96518	2044	1 99303	2045	2 02144	2046	2 05040
2047	2 07994	2048	2 11005	2049	2 14074	2050	2 17202

TABLE 19

[Ratio PIA (T) to PIA (1975) all measured in 1975 dollars, price index AIME 2 percent real growth until 1971, 1 5 percent thereafter 1975 dollar benefit 80 percent 1st 2 400, 35 percent of next 4,800, 25 percent of excess]

Year	Amount	Year	Amount	Year	Amount	Year	Amount
1975	1 00000	1976	1 02231	1977	1 04409	1978	1 06548
1979	1 07051	1980	1 07552	1981	1 08052	1982	1 08549
1983	1 09041	1984	1 09532	1985	1 10017	1986	1 10500
1987	1 10801	1988	1. 11101	1989	1 11399	1990	1 11697
1991	1 11994	1992	1 12290	1993	1 12586	1994	1 12881
1995	1 14385	1996	1 15874	1997	1 17264	1998	1 18644
1999	1 20014	2000	1 21376	2001	1 22728	2002	1 24069
2003	1 25404	2004	1 26732	2005	1 28050	2006	1 29438
2007	1 30821	2008	1 32196	2009	1 33563	2010	1 34921
2011	1 36273	2012	1 37621	2013	1 38965	2014	1 40305
2015	1 41642	2016	1 42975	2017	1 44304	2018	1 45628
2019	1 46949	2020	1 48268	2021	1 50150	2022	1 52063
2023	1 54007	2024	1 55984	2025	1 57994	2026	1 60040
2027	1 62119	2028	1 64236	2029	1 66389	2030	1 68581
2031	1 70815	2032	1 73090	2033	1 75408	2034	1 77768
2035	1 80171	2036	1 82619	2037	1 85113	2038	1 87654
2039	1 90244	2040	1 92884	2041	1 95574	2042	1 98316
2043	2 01111	2044	2 03961	2045	2 06868	2046	2 09833
2047	2 12855	2048	2 15936	2049	2 19077	2050	2 22278

As expected, changes in the rate of real earnings growth produces sizeable cost estimate differences, as can be seen by comparing tables 17 and 18 with 1.02^t and 1.015^t respectively. From this comparison, one has the estimate that lowering real growth by 0.5 percent results in costs approximately 15 percent higher in 50 years.

The main purpose of this simulation was to demonstrate the feasibility of a straightforward procedure which could be included in the cost estimation procedure of the Office of the Actuary. Clearly, this line of research needs considerable refinement and sensitivity testing before it can play a major role in cost estimation.

14. Covariance of Earnings

The matrix of variances and covariances of earnings at different ages has been computed to examine the acceptability of the assumptions underlying the basic model.[67] These computations indicate that the underlying assumption of an individual constant which does not change over an entire lifetime is not fully acceptable. Rather, the finding of a slow but continued decline in correlation coefficients with larger differences in ages indicates random movements in earnings which are not adequately captured by a first order autocorrelation

[67] This computation was completed after submission of the report but before printing Thus this section was added to the end of the paper

process. To pursue this direction of development in the model one could introduce random changes in individual constants. Thus there could be two random components—one leading to a permanent change in individual constant, the other having only a transitory effect on earnings.[68]

The precise calculations reported in table 20 can be described as follows. Consider the set of men who have positive earnings in the data set in each of the two years when they are i and j years old. For each such man and year calculate the log of earnings indexed by average wages in that year. Then for the set of men with positive earnings when they are i and j years old calculate the correlation coefficient between indexed earnings at age i and indexed earnings at age j. Table 20 reports these correlations for particular ages.[69] To read the table one adds the age difference of a row to the age heading a column. Thus the correlation between earnings at 43 and 42 is .80; between earnings at 53 and 51, .73.

TABLE 20—COEFFICIENTS OF CORRELATION BETWEEN WAGE INDEXED EARNINGS AT DIFFERENT AGES

Age	33	43	53	Age	33	43	53
Age Difference				Age Difference			
1	75	80	79	1	75	80	80
2	67	72	73	2	70	72	75
3	60	68	70	3	64	68	70
4	54	66	67	4	61	67	67
5	50	63	64	5	57	63	64
6	46	59	61	6	56	62	62
7	38	58	61	7	55	59	58
8	32	54	58	8	53	58	56
9	29	52	54	9	51	58	54
10	25	50	55	10	50	55	47
11	20	48	54	11	49	53	45
12	17	45	51	12	44	52	
13	15	40	51	13	45	46	
14		40	50	14	45	48	
15		39	44	15	43	41	
16		31	50	16	45	38	

As one would expect, the larger the difference in ages, the lower the correlation. In addition the correlations are considerably lower where the younger age is below 30.[70] Analyzing the model showed a variance in individual constants of approximately .6 and of the random component at prime ages of .3 to .4. The autocorrelation was estimated[71] to be .4. If the model in equations (4) and (6) held exactly, i.e., ignoring the effects of zeros, the correlation coefficients would be .76 with a one year gap as opposed to a range of .75–.80 in table 20. With the model, the correlation coefficients would be .68–.66 with a two year gap; .65–.63 with a three year gap; and would decrease to approximately .63–.60 as the gap increased. Considering table 20, the empirical findings are suggestive of a somewhat higher autocorrelation in the short run, together with a lower autocorrelation over longer periods. This is strongly suggestive of a drift in individual constants.

[68] A model of this type can be suggested by James Mirrlees

[69] In constructing the table, there were approximately (500) (17–, age difference,) observations for the calculation of a correlation coefficient with any given difference between the two ages

[70] Since the random components were largest at younger ages, this finding was partially to be expected, but with the magnitudes shown in the table

[71] No attempt was made to estimate autocorrelation separately by age