VARIOUS METHODS OF FINANCING OLD-AGE PENSION PLANS

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Actuarial Study No. 10

Social Security Board
Office of the Actuary

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FOREWORD

This study, outlined by the Actuarial Consultant, was started by Mr. Eugene A. Rasor, developed by Mr. Robert J. Myers and reviewed by Assistant Actuary Bronson. Discussions as to financing Old Age Pension plans (before both the Advisory Council and certain governmental agencies) have frequently assumed a single "correct" method of pension plan analysis. Instead numerous correct actuarial approaches exist.

This report should prove helpful to students of employer pension plans and social insurance programs.

VARIOUS METHODS OF FINANCING OLD-AGE PENSION PLANS

Section 201a of the Social Security Act provides that Congress shall appropriate to the Old Age Reserve Account "an amount sufficient as an annual premium to provide for the payments required - - - - - - such amount to be determined on a reserve basis in accordance with accepted actuarial principles". From this phraseology it might be assumed that there was one standard method of determining the reserve basis of an old age annuity program. Instead there are a great many methods of determining how to finance such a program. The size of the reserve fund and the growth thereof depend not only upon the benefits provided, but also upon the method of financing selected. It is the purpose of this report to discuss some of the various methods of financing a simple old-age program which pays annual annuities of $500 to all individuals aged 65 and over with no death benefits.

Old-age pension plans, particularly in regard to methods of financing, have as many aspects as the elephant in the traditional story of the blind experts. There is no typical pension plan nor is there a country, corporation, or other organization maintaining a pension plan which could be considered typical. There are occasionally references to "ultimate pension costs" following the period of select coverage. In this report a situation is assumed of a small hypothetical community with a stationary population existing under the following general assumptions:

(1) Distribution of ages as in the United States Life Table for White Males, 1920-29 (see Chart 1).

CHART 1
AGE DISTRIBUTION OF STATIONARY POPULATION

SOURCE: U.S. White Males, 1920–1929 Table

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(2) Male population divided into three categories: Children - 0-14; Workers - 15-64; Retired - 65 and over.

(3) 1,000 male births each year which maintain a stationary population of 57,846 consisting of, at the start of our observation and thereafter, of 13,520 children, 38,206 workers, 6,120 retired lives. Each year 884 children reach age 15 and 520 workers reach age 65.

(4) The manufacturing establishment is a community enterprise, engaging only men, the women being housekeepers and not brought into the pension system in any fashion.

(5) Wages and Pensions — The wage paid each worker is $1000 per annum so that the level annual total payroll is $38,206,000. The pension at 65 is $500 per annum. It is arbitrarily assumed that sharp division lines occur at the ages of 15 and 65 in regard to work commencement and work termination, and that the factors of sickness and unemployment are not present.

This series of assumptions must roughly approximate what is meant by the "ultimate" or "eventual" balance usually considered at the safe distance of 50 years.

Among the many possible ways of considering pension costs, the following discussion will present descriptions and costs of seven different methods.

Under Plan A pensions are regarded as payable to the retired by the workers. Since the population is stationary, this does not involve an increasing cost. Each year 38,206 individuals contribute $80.10 apiece to 6,120 pensioners who receive $500 each. Thus, there is contributed each year $3,060,000, or 8.0% of total payroll, all of which is paid out in benefits. This involves a complete absence of reserves and merely transfers directly the share of the workers' earnings necessary to support the retired (see Table 1 and Chart 2).

Table 1

PROGRESS OF RESERVE UNDER PLAN A

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	3,060	3,060	0	0
2	3,060	3,060	0	0
3	3,060	3,060	0	0
4	3,060	3,060	0	0
5	3,060	3,060	0	0
10	3,060	3,060	0	0
15	3,060	3,060	0	0
20	3,060	3,060	0	0
25	3,060	3,060	0	0
30	3,060	3,060	0	0
35	3,060	3,060	0	0

a/ At end of year.

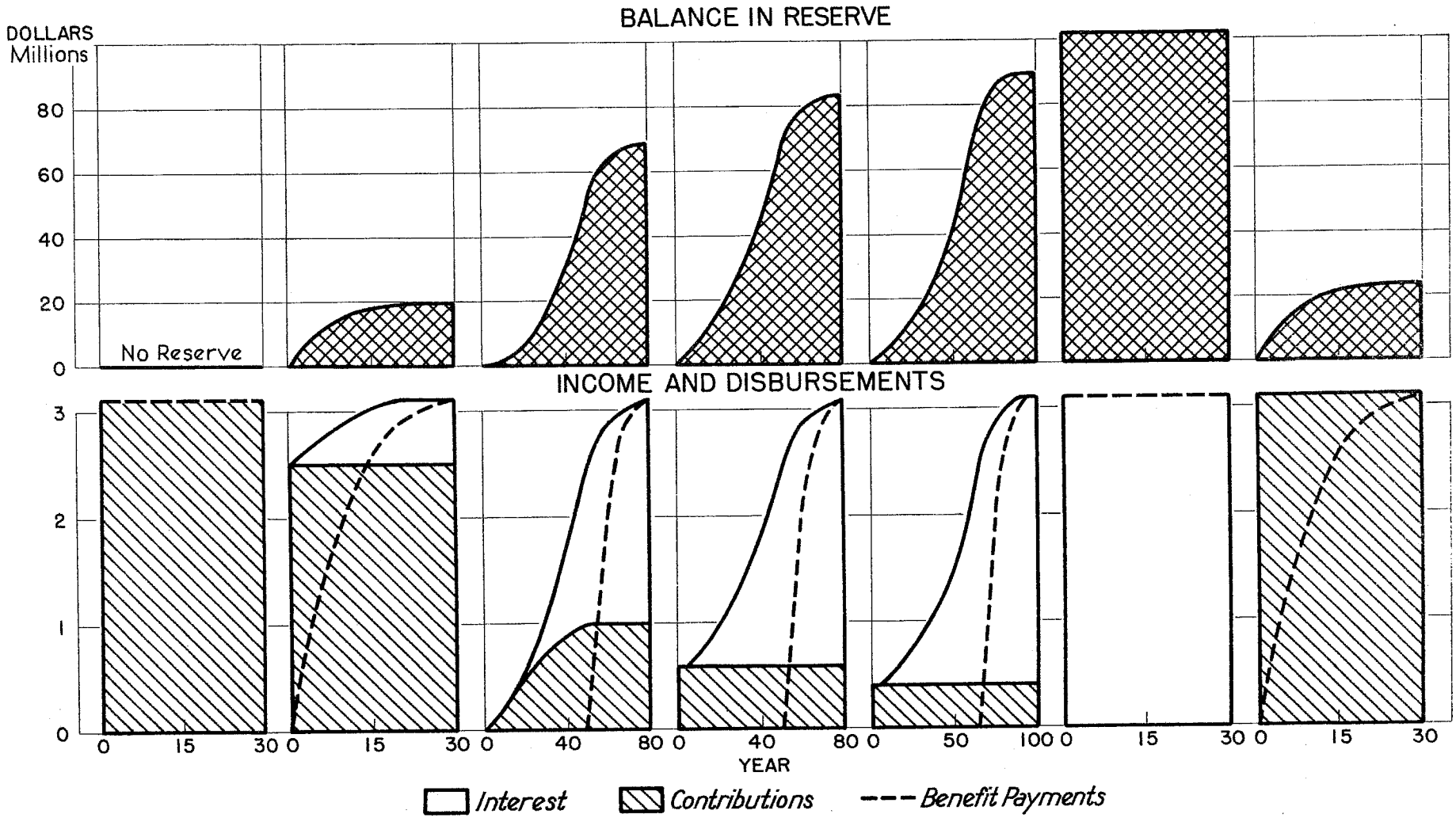
DESCRIPTION OF PLAN:

Each individual between the ages of 15 and 65 pays $80.10 each year. The total amount is divided up among the aged that year, giving $500 to each one. Provision is thus made for those over age 65 at the beginning of Year 1.

CHART 2

COST ANALYSIS OF VARIOUS PLANS OF FINANCING PENSIONS FOR STATIONARY POPULATION

PLAN A	PLAN B	PLAN C	PLAN D	PLAN E	PLAN F	PLAN G
ANNUAL CONTRIBUTION OF $3,060,000	SINGLE PREMIUM ANNUITY BOUGHT AT 65	ANNUAL PREMIUM DEF. ANNUITY BOUGHT AT 15	SINGLE PREMIUM DEF. ANNUITY BOUGHT AT 15	SINGLE PREMIUM DEF. ANNUITY BOUGHT AT BIRTH	PENSIONS PAID ENTIRELY FROM INTEREST ON RESERVE	SINGLE PREMIUM ANNUITY BOUGHT AT 65 (NO INTEREST)



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Plan B predicates an insurance carrier to whom the single premium of $4,775 is paid for each of the 520 men reaching the age of 65 within the year, or a total payment of $2,483,000 representing 6.5% of payroll. It is assumed that the insurance company is a non-profit, non-expense organization which operates on a net premium basis, and that it earns 3% on its investments. In Table 2 there is shown the progress of reserve under Plan B. The contributions are level at $2,483,000, while the benefit payments increase from $255,000 in Year 1, when payments are limited to only 520 of the 6,120 retired lives, to $3,060,000 in Year 35 when all 6,120 are in receipt of benefits. By the end of Year 35 the excess of contributions over benefit payments has resulted in a reserve fund of $19,244,000. This reserve produces interest earnings of $577,000 each year, which added to the yearly premium payment of $2,483,000 provides the necessary funds for the annual benefit payments of $3,060,000. Let it be assumed that the reserve is "invested" in the one plant in the community so that the interest (ultimately reaching $577,000) is paid by this plant, possibly by deducting it from the wages of the employees. Moreover, although the $2,483,000 is a single premium based on the retiring employees, it also is deducted from the wages of all the employees. Thus, the employees are essentially paying the total cost of annuities to the retired.

Under Plan C all children becoming workers at age 15 in Year 1 and thereafter purchase an annual premium deferred life annuity from

Table 2

PROGRESS OF RESERVE UNDER PLAN B

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	2,483	255	0	2,228
2	2,483	500	67	4,278
3	2,483	734	128	6,155
4	2,483	957	185	7,865
5	2,483	1,169	236	9,415
10	2,483	2,049	424	15,007
15	2,483	2,619	522	17,788
20	2,483	2,914	562	18,875
25	2,483	3,027	575	19,180
30	2,483	3,055	577	19,237
35	2,483	3,060	577	19,244

a/ At end of year.

DESCRIPTION OF PLAN:

A single premium life annuity of $500 is purchased for each individual attaining age 65 in Year 1 and thereafter. No provision is made for those over age 65 at the beginning of Year 1.

the insurance company. Figures for this plan are presented in Table 3. For an annual premium of $26.70, payable from age 15 to age 64 inclusive, the individual receives a life annuity of $500 per year, beginning at age 65. Thus, since all individuals who are over 15 years of age in Year 1 do not share in the plan, no benefits are payable until Year 51 when the first entrants become 65. The number of contributors increases from year to year until in Year 50 and thereafter the number remains constant at 38,206, the total of the individuals in the community aged 15 to 65. Likewise, the total contributions to the fund increase from $24,000 in Year 1 to $1,020,000 in Year 50 and thereafter. The ultimate contributions are thus 2.7% of total payroll. The benefit payments increase from $255,000 in Year 51 to $3,060,000 in Year 85 and thereafter. Since there are no benefit payments in the first 50 years, the reserve builds up steadily throughout the period until by Year 50 it is almost $50,000,000. Thereafter the reserve continues to build up slowly since the contributions plus interest on the reserve continue to exceed the benefit payments until the ultimate condition when they just balance. At this time the reserve is $67,986,000 which provides interest of $2,040,000. Ultimately, this 3% interest on the reserve plus the premiums received in the year are just sufficient to meet payments to the retired employees with the reserve remaining intact as a special capital fund in the plant.

Under Plan D each year as a child goes to work at the age of 15,

Table 3

PROGRESS OF RESERVE UNDER PLAN C

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	24	0	0	23
5	117	0	7	366
10	232	0	34	1,404
20	455	0	158	5,896
35	765	0	577	20,563
50	1,020	0	1,390	48,742
51	1,020	255	1,462	50,970
55	1,020	1,169	1,698	58,157
60	1,020	2,049	1,887	63,749
65	1,020	2,619	1,984	66,530
70	1,020	2,914	2,025	67,617
75	1,020	3,027	2,037	67,922
80	1,020	3,055	2,039	67,979
85	1,020	3,060	2,040	67,986
90	1,020	3,060	2,040	67,986

a/ At end of year.

DESCRIPTION OF PLAN:

An annual premium deferred life annuity of $500 beginning at age 65 is purchased for each individual attaining age 15 in Year 1 and thereafter. No provision is made for those over age 15 at the beginning of Year 1. Thus no annuity payments are made until Year 51 when those who were 15 in Year 1 first enter the retired class. There is no death benefit for those dying before age 65.

there is paid in his behalf a single premium for a deferred life annuity of $500 beginning 50 years later at age 65. This single premium is $640 and, since each year 884 persons attain age 15, the total contributions each year are $566,000, or 1.5% of payroll. Figures for this plan are presented in Table 4. Just as in Plan C, all persons over the age of 15 in Year 1 are excluded from the plan so that no benefit payments are made until Year 51. As a result of the level income through single premium contributions of $566,000, the reserve builds up steadily until in Year 50 it is about $65,000,000. Thereafter the reserve continues to build up slowly because the contributions plus the interest on the reserve exceed the benefit payments until the ultimate situation is reached in Year 90. At that time the reserve has reached a figure of $83,122,000. This reserve invested in the community plant at 3% produces interest of $2,494,000. This is just sufficient with the total single premiums of $566,000 to equal the amount paid to the annuitants--$3,060,000. All of the payments are met by reducing the income of the joint employees and owners of the plant.

Under Plan E for each child born there is paid to the insurance company in his behalf a single premium of $363 for a deferred life annuity of $500, beginning at age 65. Figures for this plan are presented in Table 5. Under this plan all persons alive at the beginning of Year 1 are excluded from the plan, only those being born in this year and future years being included. As a result no benefit payments are made until Year 66. Each year the total contributions to the fund are $363

Table 4

PROGRESS OF RESERVE UNDER PLAN D

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	566	0	0	566
5	566	0	71	3,007
10	566	0	173	6,492
20	566	0	427	15,217
35	566	0	981	34,240
50	566	0	1,844	63,878
51	566	255	1,916	66,105
55	566	1,169	2,152	73,293
60	566	2,049	2,341	78,885
65	566	2,619	2,438	81,666
70	566	2,914	2,479	82,753
75	566	3,027	2,491	83,058
80	566	3,055	2,493	83,115
85	566	3,060	2,494	83,121
90	566	3,060	2,494	83,122

a/ At end of year.

DESCRIPTION OF PLAN:

A single premium deferred life annuity of $500 beginning at age 65 is purchased for each individual attaining age 15 in Year 1 and thereafter. No provision is made for those over 15 at the beginning of Year 1. Thus no annuity payments are made until Year 51 when those who were 15 in Year 1 first enter the retired class. There is no death benefit for those dying before age 65.

Table 5

PROGRESS OF RESERVE UNDER PLAN E

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	363	0	0	363
10	363	0	111	4,167
20	363	0	274	9,767
35	363	0	630	21,977
50	363	0	1,184	41,001
65	363	0	2,047	70,638
66	363	255	2,119	72,866
70	363	1,169	2,355	80,053
75	363	2,049	2,544	85,645
80	363	2,619	2,641	88,426
85	363	2,914	2,681	89,513
90	363	3,027	2,694	89,818
95	363	3,055	2,696	89,875
100	363	3,060	2,697	89,882

a/ At end of year.

DESCRIPTION OF PLAN:

A single premium deferred life annuity of $500 beginning at age 65 is purchased at time of birth for each individual born in Year 1 and thereafter. No provision is made for those alive in the population at the beginning of Year 1. Thus, no annuity payments are made until Year 66 when those who were born in Year 1 first enter the retired class. There is no death benefit for those dying before age 65.

for each of the 1000 births, or a total of $363,000 which is .95% of payroll. Since no benefit payments are made for the first 65 years, the reserve builds up steadily until in Year 65 it is about $70,000,000. Thereafter the reserve continues to increase slowly since the benefit payments do not equal the total contributions plus the interest on the reserve until the ultimate condition has been reached in Year 100. At this time the reserve has reached a figure of $89,882,000 which produces interest payments of $2,697,000. This interest payment is just sufficient with the $363,000 contributions to pay the total benefits of $3,060,000 in each year thereafter.

Plan F appears to be the complete antithesis of Plan A. Under Plan A there is no reserve of any sort with benefit payments for all the aged being paid from current contributions. On the other hand, under Plan F it is contemplated that by some means or other a reserve so large is accumulated that 3% interest on it will carry the entire pension cost. To meet the benefit payments of $3,060,000 it is necessary to have a reserve of $102,000,000 invested at 3% interest (see Table 6). With this reserve developed from prior investment no future premium payments are necessary. This amount invested in the community plant calls for the payment of $3,060,000 each year from its income. Eventually there may occur to the community the thought that the payment of this interest on the reserve is exactly the same as the payment of $80 in respect to each of the employees for the behalf of the aged. At this time Plan F reverts directly to Plan A.

Table 6

PROGRESS OF RESERVE UNDER PLAN F

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Interest on Reserve	Balance in Reserve[a/]
1	0	3,060	3,060	102,000
2	0	3,060	3,060	102,000
3	0	3,060	3,060	102,000
4	0	3,060	3,060	102,000
5	0	3,060	3,060	102,000
10	0	3,060	3,060	102,000
15	0	3,060	3,060	102,000
20	0	3,060	3,060	102,000
25	0	3,060	3,060	102,000
30	0	3,060	3,060	102,000
35	0	3,060	3,060	102,000

a/ At end of year.

DESCRIPTION OF PLAN:

A reserve fund of $102,000,000 is set up in Year 1, and it provides sufficient interest to pay $500 pensions to all persons aged 65 and over in Year 1 and thereafter. No contributions for the workers are necessary.

So far in this discussion it has always been assumed that excess of contributions over current benefit payments could be invested at 3% compound interest. It is now assumed that no interest can be earned on such funds, but that nevertheless, it is necessary to accumulate funds to guarantee the participants that they will receive the benefits already promised to them regardless of the termination of the plan at any time. Any of the methods of financing as set down in Plans B to E could be used under this "no interest" concept. Plan G, which is the parallel to Plan B, assumes that in Year 1 and each subsequent year there is set up for each individual attaining age 65 a lump sum of $5,884. This sum is the average amount of benefits that will be received by a 65 year old individual on the basis of a $500 annual pension. For a large group of individuals who have just retired at age 65, such a fund is exactly sufficient to pay pensions for life to the entire group. In other words, the excess of the single premium of $5,884 over the benefits received by those who die in the early years goes toward paying the pensions of those who live for more than 12 years, and who thus receive benefits in excess of their individual single premium. The figures for this plan are presented in Table 7. Under Plan G it should be noted that no provision is made for those over age 65 at the beginning of Year 1.

The total contributions each year remain constant at $3,060,000 since $5,884 is paid in respect to each of the 520 men attaining age 65 each year. The total contributions exceed the annual benefit payments

Table 7

PROGRESS OF RESERVE UNDER PLAN G

(All figures in thousands of dollars)

Year	Total Contributions	Benefit Payments	Balance in Reserve[a/]
1	3,060	255	2,805
2	3,060	500	5,366
3	3,060	734	7,692
4	3,060	957	9,795
5	3,060	1,169	11,686
10	3,060	2,049	18,377
15	3,060	2,619	21,599
20	3,060	2,914	22,826
25	3,060	3,027	23,162
30	3,060	3,055	23,224
35	3,060	3,060	23,231

a/ At end of year.

DESCRIPTION OF PLAN:

In Year 1 and each year thereafter there is set up for each individual attaining age 65 a lump sum payment equal to the average amount of benefits that will be received per individual (based on a $500 pension for persons retiring at 65). It is assumed that no interest can be earned on the accumulated funds. No provision is made for those over age 65 at the beginning of Year 1.

The reserve at any time is just sufficient to continue to pay life pensions to those already on the pension roll without any further income in the form of contributions (or interest).

until the ultimate situation has been reached in Year 35, at which time the two just balance. In the meantime, the excess of contributions over benefit payments accumulates to a total of $23,231,000. It should be remembered that this accumulation is not accomplished through interest payments. It might be said to be the result of placing the excess of the contributions over benefit payments in a safe deposit box or else in the proverbial sock. The reserve at any time is just sufficient to continue to pay pensions to those already on the roll without any further income in the form of contributions. It can thus be seen that the reserve does not tend to decrease the cost of the program as it would if interest were earned. On the other hand, it merely acts as a safeguard in case of discontinuance of the program. However, this reserve is achieved at the price of not paying the individuals who were aged 65 and over in Year 1; this group could have been pensioned if the total contributions had been used entirely for benefit payments as under Plan A.

If similar cost comparisons were carried out for the "no interest" parallels to Plans C, D, and E, the accumulated fund would be even greater than under Plan G. This would be due to the fact that under all "no interest" concepts the ultimate annual contributions required would be the same, $3,060,000. However, under the latter three plans the payment of benefits is deferred for a longer period of years so that there would be a larger accumulation of funds. For example, under the "no interest" concept of Plan D where a single

premium is set up at age 15, the annual contributions would be $3,060,000 every year. However, there would be no benefit payments for the first 50 years so that the accumulated fund at the end of that time would be the 50 years' contributions, or $153,000,000. In the next 35 years this accumulation would be further increased because the benefit payments would not equal the contributions until the ultimate condition was reached. The larger reserves arising under the "no interest" concepts of Plans C, D, and E are due to the fact that the fund, at any time, must be just sufficient to continue to pay pensions to those already on the roll for the rest of their lives and also to provide pensions to those workers who have contributed, but who are not yet in receipt of benefits. Under Plan C if the annual premiums cease, the pension liability for the current workers would only be limited to the partial amount already paid in.

In Tables 8a and 8b there is presented a summary of the various methods of financing and also various pertinent cost data for each plan. From Table 8b it may be seen that for all plans the ultimate benefit payments are about 8% of payroll, while the ultimate contributions range from zero to 8% of payroll. The ultimate reserve for Plan F is almost three times as large as the annual payroll.

This review of pension financing aspects indicates that costs can be regarded as zero when there is a sufficient endowment to pay the pensions; this was the original theory back of the pensions to be paid its retired teachers by the Carnegie Foundation for the Advancement

Table 8a

SUMMARY OF METHODS OF FINANCING AND COSTS OF PLANS A TO G

(All figures of last 4 columns in thousands of dollars)

	Method of Financing	Individual Payment	Pensions Begin in Year	Years to Ultimate	Ultimate Benefits	Ultimate Contributions	Ultimate Interest	Ultimate Reserve
Plan A	Pensions to retired, paid by all workers	$80.10	1	0	3,060	3,060	0	0
Plan B	Single premium annuity bought at 65	$4775	1	35	3,060	2,483	577	19,244
Plan C	Annual premium annuity from 15 to 65	$26.70	51	85	3,060	1,020	2,040	67,986
Plan D	Single premium deferred annuity bought at 15	$640	51	85	3,060	566	2,494	83,122
Plan E	Single premium deferred annuity bought at birth	$363	66	100	3,060	363	2,697	89,882
Plan F	Pensions paid entirely from interest on reserve	0	1	0	3,060	0	3,060	102,000
Plan G	Single premium annuity bought at 65 (no interest)	$5884	1	35	3,060	3,060	0	23,231

Table 8b

SUMMARY OF ULTIMATE COSTS OF PLANS A TO G AS PERCENTAGE OF PAYROLL

	Method of Financing	Ultimate Benefits	Ultimate Contributions	Ultimate Interest	Ultimate Reserve	Ultimate Contributions as % of Plan A	Ultimate Interest as % of Plan F
Plan A	Pensions to retired, paid by all workers	8.01%	8.01%	.00%	0%	100%	0%
Plan B	Single premium annuity bought at 65	8.01	6.50	1.51	50	81	19
Plan C	Annual premium annuity from 15 to 65	8.01	2.67	5.34	178	33	67
Plan D	Single premium deferred annuity bought at 15	8.01	1.48	6.53	218	18	82
Plan E	Single premium deferred annuity bought at birth	8.01	.95	7.06	235	12	88
Plan F	Pensions paid entirely from interest on reserve	8.01	.00	8.01	267	0	100
Plan G	Single premium annuity bought at 65 (no interest)	8.01	8.01	.00	0	100	0

of Teaching. Similarly, pension costs can be regarded in a great many other ways: first, as the total annual cost of actual pension payments; second, as the discounted costs of pension payments, discounting them to age at retirement, age of entering work, or to birth; or finally, as the discounted costs of pension payments spread uniformly over the working span as an annual premium. When the pension program involved presents the desirability of the insurance company method, there may be some emphasis upon reduced cost through setting aside money in advance. However, where the whole carrying organization is a unit and must itself pay the interest on the investments, the preceding discussion shows that the apparent savings through bringing in interest ignores the fact that the interest payers are identical with the group that pay the premiums, whence it is evident that there may be no saving whatever in the ultimate situation.

An interesting problem to consider is the transition from one method of financing to another. Assuming that the purpose of pension plans is, in all cases, to pay benefits to the aged and that economy will not mean the failure to pay pensions, there may be a normal transition successively from Plan A to Plan F.

In Table 9 there are presented figures for the transition from Plan A to Plan B. Divorcing now the insurance-carrying aspect from the premium-paying aspect, the community as a whole goes from a method of paying pensions to all the aged, amounting to $3,060,000, up to a combination method of putting up a single premium for all those reaching

Table 9

PROGRESS OF RESERVE FOR TRANSITION FROM PLAN A TO PLAN B

(All figures in thousands of dollars)

Year	Total Contributions	Total Benefit Payments			Interest on Reserve	Balance in Reserve[a/]
		Plan A	Plan B	Total		
0	3,060	3,060	0	3,060	0	0
1	5,288	2,805	255	3,060	0	2,228
2	5,043	2,560	500	3,060	67	4,278
3	4,809	2,326	734	3,060	128	6,155
4	4,586	2,103	957	3,060	185	7,866
5	4,374	1,891	1,169	3,060	236	9,416
10	3,493	1,011	2,049	3,060	424	15,007
15	2,924	441	2,619	3,060	522	17,788
20	2,628	146	2,914	3,060	562	18,875
25	2,515	33	3,027	3,060	575	19,180
30	2,487	5	3,055	3,060	577	19,237
35	2,483	0	3,060	3,060	577	19,244

a/ At end of year.

DESCRIPTION OF TRANSITION:

All individuals over age 65 at the beginning of Year 1 receive pensions under Plan A. Those attaining age 65 in Year 1 and thereafter receive pensions under Plan B; i.e., a single premium life annuity is purchased for them when they attain age 65.

age 65 in Year 1 and thereafter. All those over 65 in Year 1 continue under Plan A and receive pensions which are paid for currently by the workers. The transition is assumed to occur as of the beginning of Year 1. In Year 1 the total contributions required are $5,288,000 as compared to $3,060,000 in the previous year under Plan A alone. The annual amount required in subsequent years decreases slowly to $2,483,000 in Year 35 and thereafter. This decrease is due to the fact that the number of individuals paid under Plan A decreases steadily due to death, since all new pensioners come under Plan B. Somewhere around Year 7 the total benefit payments under Plan B equal those under Plan A. Thereafter the benefit payments under Plan B exceed those under Plan A until in Year 35 the benefit payments under Plan B are $3,060,000, while those under Plan A are negligible. It should be noted that the annual benefit payments are the same for all years since all individuals aged 65 and over receive $500 pensions under one plan or the other.

Since the total annual contributions exceed the benefit payments for Years 1 to 14, there is an accumulation of funds. Even after Year 14, the fund continues to increase because the annual contributions plus the interest exceed the benefit payments until the ultimate condition is reached. As a result, a reserve is built up which increases to almost $18,000,000 in Year 15 and grows slowly thereafter, until in Year 35 it is over $19,000,000. When this ultimate condition is reached in Year 35, the interest on the reserve

plus the total contributions just equal the benefit payments. It might be noted that the ultimate reserve, as shown here, is, of course, the same as that shown in Table 1, in which Plan B was developed independently. Thus, in a transition from Plan A to Plan B the community, by increasing their annual contributions by as much as 70% in the early years, ultimately effects a reduction in the annual contribution of almost 20%. However, ultimately an interest payment just equal to this 20% saving must be met from the income of the plant.

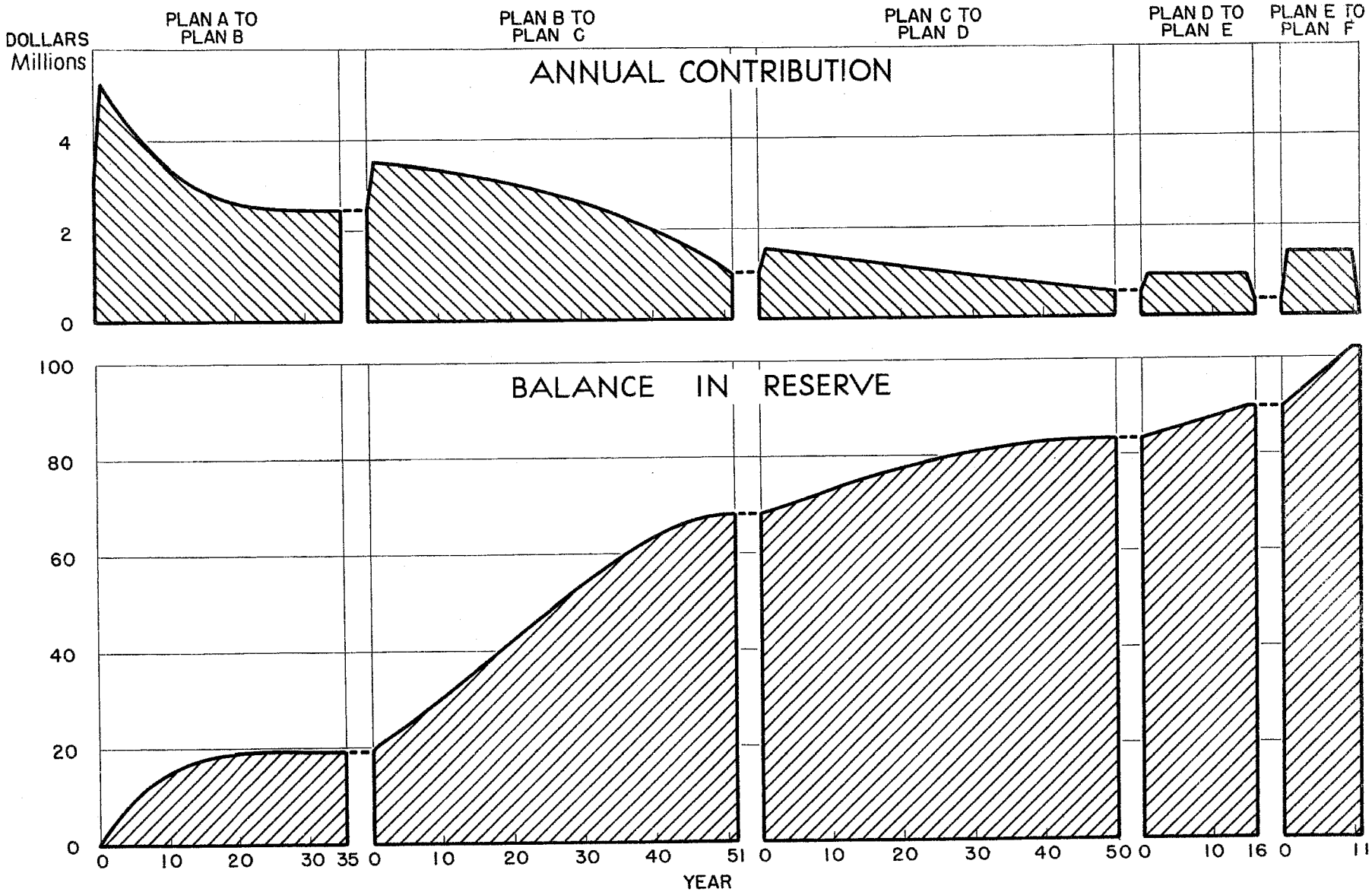
This transition (as well as others to be discussed later) is shown graphically in Chart 3.

In Table 10 there are presented figures for the transition from Plan B to Plan C. The community now decides to purchase annual premium deferred annuities for all the workers rather than taking care of them as they reach retirement age. An annual premium of $26.70 is put up in respect to each of the workers aged 15-64. This annual premium is sufficient to purchase an annual annuity of $500 beginning at age 65 for individuals who begin premium payment at age 15. Thus, for the present group of workers this annual premium will purchase only a portion of the $500 annuity, ranging from about 1% for those aged 64 to 65 to almost 100% for those 15 to 16. The remainder of the $500 annuity is purchased under Plan B by buying a single premiun annuity at age 65.

As a result of this complex transition all those who are over 65 at the beginning of Year 1 continue to receive pensions under Plan B.

CHART 3

TRANSITIONS BETWEEN VARIOUS PLANS OF FINANCING



SOCIAL SECURITY BOARD

OFFICE OF THE ACTUARY

Table 10

PROGRESS OF RESERVE FOR TRANSITION FROM PLAN B TO PLAN C

(All figures in thousands of dollars)

Year	Total Contributions	Total Benefit Payments				Interest on Reserve	Balance in Reserve[a/]
		Under Plan B	Under Joint Plan		Total		
			Plan B	Plan C			
0	2,483	3,060	0	0	3,060	577	19,244
1	3,503	2,805	253	2	3,060	577	20,264
2	3,488	2,560	495	5	3,060	608	21,300
3	3,473	2,326	726	8	3,060	639	22,352
4	3,456	2,103	942	15	3,060	671	23,419
5	3,438	1,891	1,146	23	3,060	703	24,500
10	3,334	1,011	1,961	88	3,060	869	30,097
15	3,203	441	2,424	195	3,060	1,043	35,950
20	3,040	146	2,571	343	3,060	1,222	41,941
25	2,843	33	2,495	532	3,060	1,402	47,916
30	2,606	5	2,291	764	3,060	1,577	53,674
35	2,323	0	2,015	1,045	3,060	1,738	58,951
40	1,988	0	1,680	1,380	3,060	1,878	63,406
45	1,591	0	1,281	1,779	3,060	1,983	66,603
50	1,123	0	809	2,251	3,060	2,037	67,986
51	1,020	0	716	2,344	3,060	2,040	67,986
60	1,020	0	179	2,881	3,060	2,040	67,986
70	1,020	0	16	3,044	3,060	2,040	67,986
80	1,020	0	0	3,060	3,060	2,040	67,986

a/ At end of year.

DESCRIPTION OF TRANSITION:

All individuals over age 65 at the beginning of Year 1 continue to receive pensions under Plan B. Individuals between the ages of 15 and 65 at the beginning of Year 1 receive part of their $500 pension under Plan C and the remainder under Plan B. Those attaining age 15 in Year 1 and thereafter receive pensions entirely under Plan C when they become 65 (in Year 51 and thereafter).

Individuals between the ages of 15 and 65 at the beginning of Year 1 receive pensions jointly under Plans B and C, while those attaining age 15 in Year 1 and thereafter receive their pensions entirely under Plan C. Under this transition the community, as a whole, goes from paying total premiums of $2,483,000 in Year 0 under Plan B to $3,503,000 in Year 1. The total contributions required annually thereafter decrease slowly until in Year 51 and thereafter they are $1,020,000. This gradual decrease arises from the combination method of financing. The total contributions based on the annual premium of $26.70 per worker are constant at $1,020,000 in Year 1 and thereafter. However, a further contribution is required under Plan B to purchase the difference between the $500 pensions and the amount purchased by the annual premiums under Plan C. This difference decreases from year to year, since the workers attaining age 65 have paid the annual premium for a longer time, dating from a younger age so that relatively more of their annuity comes from Plan C.

The total benefit payments which arise solely under Plan B decrease rapidly from $3,060,000 in Year 0 until by Year 35 they are negligible. This is, of course, due to the fact that only the current aged as of the time of the inauguration of the transition are included solely under Plan B. In the early years the benefit payments under the joint plan are predominantly from Plan B. Thus, in Year 1 the benefit payments under Plan C are only about 1% of those under Plan B for individuals in the joint plan. This, as explained

previously, arises from the small amount purchased by the annual premiums under Plan C for individuals who were 64 to 65 in Year 1. The proportion of the benefit payments under the joint plan which arise from Plan C increases steadily until by about Year 42 it is 50%. By Year 80 almost all of the benefit payments are made under Plan C since by that time practically all of the individuals who were aged 15 and over in Year 1 are dead. It should be noted that the annual benefit payments are the same for all years since all individuals aged 65 and over receive $500 pensions under one plan or another.

The total annual contributions exceed the benefit payments up until about Year 20. As a result there is a rapid accumulation of funds for the first 20 years, the reserve increasing from 19 million dollars (the ultimate reserve under Plan B) to 42 million dollars in Year 20. After Year 20 the fund continues to increase because the annual contributions plus the interest on the reserve exceed the benefit payments until the ultimate condition is reached. Thus, the reserve continues to grow until in Year 50 it is about 68 million dollars, the ultimate reserve under Plan C. It might be noted that although the ultimate financial condition is reached by Year 51, the ultimate condition in regard to the distribution of the benefit payments between Plans B and C is not reached until Year 80.

The community, as a result of the transition from Plan B to Plan C, ultimately effects a reduction of about 60% in the annual contribution. This is achieved through increasing the annual contributions

by as much as 40% in the early years. As a result the balance in reserve is built up so as to yield larger interest payments. Ultimately these interest payments exactly equal the 60% savings in annual contributions. These interest payments must come from the income of the community plant.

Next considering the transition from Plan C to Plan D; the community desires to pay for the pensions by means of a single premium of $640 at age 15 rather than collecting annual premiums of $26.70 from ages 15 to 64. However, it is decided that all individuals who are over 15 as of Year 1 shall continue to pay premiums and receive pensions under Plan C with only those who attain age 15 in Year 1 and thereafter coming under Plan D.

From Table 11 it can be seen that the total contributions required in Year 1 are $1,563,000 as compared to $1,020,000 in the previous year under Plan C. The annual contributions decrease in subsequent years until in Year 50 and thereafter they are $566,000. The total contributions in Years 1 to 50 are made up of two parts: first, $566,000 in respect to each of the children attaining age 15 in the year; and second, the annual premiums from those workers who are still under Plan C. Since this number decreases from year to year, the latter part of the total contributions decreases steadily. For the first 50 years no benefit payments are made under Plan D because the first entrants do not attain age 65 until Year 51. Starting in Year 51, the benefit payments under Plan D increase rapidly, while those under

Table 11

PROGRESS OF RESERVE FOR TRANSITION FROM PLAN C TO PLAN D

(All figures in thousands of dollars)

Year	Total Contributions	Total Benefit Payments			Interest on Reserve	Balance in Reserve[a/]
		Plan C	Plan D	Total		
0	1,020	3,060	0	3,060	2,040	67,986
1	1,563	3,060	0	3,060	2,040	68,529
2	1,540	3,060	0	3,060	2,056	69,065
3	1,516	3,060	0	3,060	2,072	69,593
4	1,493	3,060	0	3,060	2,088	70,114
5	1,470	3,060	0	3,060	2,103	70,627
10	1,355	3,060	0	3,060	2,178	73,074
15	1,242	3,060	0	3,060	2,246	75,308
20	1,132	3,060	0	3,060	2,308	77,307
25	1,025	3,060	0	3,060	2,362	79,048
30	921	3,060	0	3,060	2,407	80,508
35	822	3,060	0	3,060	2,444	81,663
40	728	3,060	0	3,060	2,471	82,493
45	642	3,060	0	3,060	2,487	82,982
50	566	3,060	0	3,060	2,493	83,122
51	566	2,805	255	3,060	2,494	83,122
60	566	1,011	2,049	3,060	2,494	83,122
70	566	146	2,914	3,060	2,494	83,122
80	566	5	3,055	3,060	2,494	83,122
90	566	0	3,060	3,060	2,494	83,122

a/ At end of year.

DESCRIPTION OF TRANSITION:

All individuals over age 65 at the beginning of Year 1 continue to receive pensions under Plan C. Individuals between the ages of 15 and 65 at the beginning of Year 1 continue to pay the annual premium under Plan C and thus the entire $500 pension at age 65 for this group comes from Plan C. Those attaining age 15 in Year 1 and thereafter receive pensions entirely under Plan D when they become 65 (in Year 51 and thereafter).

Plan D increase rapidly, while those under Plan C decrease at a corresponding rate, although the total at all times is $3,060,000. This trend is, of course, due to the fact that no new pensioners from Plan C are placed on the rolls after Year 50.

Although the total annual contributions never exceed the benefit payments, the reserve continues to build up because of the interest on the reserve. In Year 50 the reserve has grown to 83 million dollars as compared to 68 million dollars in Year 0. This ultimate reserve is, of course, the same as that shown in Table 3 in which Plan D was developed independently. In changing from Plan C to Plan D the community increases its annual contribution by as much as 50% in the early years. However, ultimately the required annual contribution is about 45% less than that under Plan C. This 45% savings is made up from increased interest payments on the larger reserve, such interest payments coming from the income of the plant.

The community, having reduced the annual outlay as contributions to only slightly more than $550,000 or only about 20% of the benefit payments, now desires to further reduce the total contributions by a transition from Plan D to Plan E. Now the pensions will be paid for by a single premium of $363 at age 0 in respect to each child born rather than paying $640 at age 15 for each child when he becomes a worker. As of Year 1 when the transition is made, all individuals aged 15 and over will already have been provided for. In the plan for transition it is decided to keep Plan D for all children between the ages of

0 and 15, but to use Plan E for all subsequent births.

As a result of this arrangement, the community will have a double burden for 15 years since it must provide both for the births and the children attaining age 15. From Table 12 it can be seen that for the former class the annual contribution will be $363,000, while for the latter group it will be $567,000 for the next 15 years, or a total of $930,000. After Year 15 the total annual contributions will be $363,000. As a result of this transition, the annual contributions are increased by 65% for 15 years with a subsequent resulting reduction of 35% in cost over Plan D.

For the first 65 years all benefit payments will be made under Plan D since individuals coming under Plan E include only those who are born in Year 1 and thereafter. However, in Year 66 and thereafter an increasing proportion of the total benefit payments of $3,060,000 are made under Plan E until by Year 100 all benefit payments will be made under Plan E.

As a result of the appreciable increase in the total annual contributions in Years 1-15, the balance in reserve grows steadily from 83 million dollars in Year 0, the ultimate reserve under Plan D, to 90 million dollars in Year 15, which is the ultimate reserve under Plan E. However, although the total annual contributions have been decreased by 35% or about 200 thousand dollars, the increased reserve meets this deficiency through larger interest payments. As in all previous cases, this increased amount of interest payments must come

Table 12

PROGRESS OF RESERVE FOR TRANSITION FROM PLAN D TO PLAN E

(All figures in thousands of dollars)

Year	Total Contributions	Total Benefit Payments			Interest on Reserve	Balance in Reserve[a/]
		Plan D	Plan E	Total		
0	566	3,060	0	3,060	2,494	83,122
1	930	3,060	0	3,060	2,494	83,486
2	930	3,060	0	3,060	2,505	83,861
3	930	3,060	0	3,060	2,516	84,247
4	930	3,060	0	3,060	2,527	84,644
5	930	3,060	0	3,060	2,539	85,053
10	930	3,060	0	3,060	2,604	87,289
15	930	3,060	0	3,060	2,680	89,882
16	363	3,060	0	3,060	2,697	89,882
20	363	3,060	0	3,060	2,697	89,882
40	363	3,060	0	3,060	2,697	89,882
60	363	3,060	0	3,060	2,697	89,882
65	363	3,060	0	3,060	2,697	89,882
66	363	2,805	255	3,060	2,697	89,882
70	363	1,891	1,169	3,060	2,697	89,882
80	363	441	2,619	3,060	2,697	89,882
90	363	33	3,027	3,060	2,697	89,882
100	363	0	3,060	3,060	2,697	89,882

a/ At end of year.

DESCRIPTION OF TRANSITION:

All individuals over age 15 at the beginning of Year 1 receive pensions at age 65 under Plan D; these have already been paid for (when the individual was 15 years old). Individuals between the ages of 0 and 15 at the beginning of Year 1 pay the single premium under Plan D when they attain age 15. All individuals born in Year 1 and thereafter pay the single premium under Plan E at time of birth and receive pensions entirely under Plan E when they become 65 (in Year 66 and thereafter).

from the income of the plant.

Finally, the community decides that it would be the ideal situation to have a reserve so large that interest on it will carry the full burden of the benefit payments rather than paying out $363,000 per year under Plan E. It is thus desired to change from Plan E to Plan F by making equal payments of $1,420,000 for a period of 10 years (see Table 13). This represents an annual payment almost four times as large as that under Plan E. However, after Year 10 no contributions are necessary, the reserve having increased to 102 million dollars. 3% interest on this reserve is just sufficient to provide the $3,060,000 of benefit payments.

Having arrived at Plan F under which all benefit payments are met by interest on the reserve, the transition back to Plan A is merely made by a book cancellation of the reserve. The item "Interest on Reserve" would thereafter be labelled as "Contributions" since the company could pay just this aggregate additional amount to the fund in behalf of the workers due to no longer having to pay interest on the bonds of the reserve.

In assuming these transitions in retrospect, it can be seen that in changing from Plan A to Plan B a period of 35 years was necessary before contributions reached the ultimate level under Plan B. Similarly, from Plan B to Plan C a period of 50 years was necessary, while from Plan C to Plan D the period was also 50 years. From Plan D to Plan E a period of 15 years was required, while from Plan E to

Table 13

PROGRESS OF RESERVE FOR TRANSITION FROM PLAN E TO PLAN F

(All figures in thousands of dollars)

Year	Total Contributions	Total Benefit Payments			Interest on Reserve	Balance in Reserve[a/]
		Plan E	Plan F	Total		
0	363	3,060	0	3,060	2,697	89,882
1	1,420	3,060	0	3,060	2,697	90,939
2	1,420	3,060	0	3,060	2,728	92,027
3	1,420	3,060	0	3,060	2,761	93,148
4	1,420	3,060	0	3,060	2,794	94,302
5	1,420	3,060	0	3,060	2,829	95,491
10	1,420	3,060	0	3,060	3,019	102,000
11	0	3,060	0	3,060	3,060	102,000
20	0	3,060	0	3,060	3,060	102,000
40	0	3,060	0	3,060	3,060	102,000
60	0	3,060	0	3,060	3,060	102,000
65	0	3,060	0	3,060	3,060	102,000
66	0	2,805	255	3,060	3,060	102,000
70	0	1,891	1,169	3,060	3,060	102,000
80	0	441	2,619	3,060	3,060	102,000
90	0	33	3,027	3,060	3,060	102,000
100	0	0	3,060	3,060	3,060	102,000

a/ At end of year.

DESCRIPTION OF TRANSITION:

All individuals alive at the beginning of Year 1 receive pensions under Plan E; these have already been paid for (when the individual was born). It is decided to build the reserve up to $102,000,000 by ten equal payments so that interest on the reserve will pay for all pensions. All individuals born in Year 1 and thereafter receive pensions entirely under Plan F when they become 65 (in Year 66 and thereafter).

Plan F 10 years was required. Thus in considering the financial cost, a period of 160 years is necessary in changing gradually from Plan A to Plan F. However, if the period required to change from all the benefit payments under one plan to all those under the next one were considered instead, this time would be greatly increased (405 years) since the total contributions tend to stabilize sooner than the distribution of the benefit payments between the various plans.

All of the previous methods are equally valid actuarial cost analyses. There are, however, many other variants which are possible. It cannot be maintained that one method of approach is theoretically more logical than another. In addition, it is conceivable that there should be brought into the picture annuities for wives and widows of the workers and also for any dependent children of deceased workers or pensioners. If this were done, there would be the possibility of financing the plan by reducing the pension to the male annuitant so as to divide the benefits with surviving female beneficiaries. There is also the further option of additional reduction to bring in, without an increase in total benefit payments, some provision for orphan children.

The true "cost" of pensions might be said to be, under any plan, the total benefits actually paid to the retired employees as of the year in which they receive them. It might also be said that the primary beneficiaries of a pension plan are those actually retired people whose need of some income makes the employer consider actual benefits

in their behalf. The priority of pension consideration is undoubtedly first, the present aged; second, the current workers near retirement age; third, other current workers; and fourth, those who have not yet gone to work.

No pension program which changes this order is sufficiently realistic. The goal of all the thrift agencies is obviously the appeal to the second and third groups, the workers who have the money to make provision for their own future. However, this is not pensions but savings and if it worked 100% and had worked 100% in the past, no pension consideration would be necessary at all. Attention is always attracted to pension need by the lack of funds in the possession of the retiring group. Making provision for the present retired group in order to build up savings plans for generations hence is not the function of a pension plan. Rather it is the function of a thrift program which can supplement any pension system designed to give a minimum of provision to the aged. Quite frequently the two are actually combined.

In almost all private handling of pensions, priority is apt to begin with the workers who are not terminating, while no consideration is given to workers who have already terminated their working careers. In this fashion there is a delusive appearance of low costs, an appearance which frequently makes the later costs of a permanent plan seem unreasonably high. These programs with the initial low costs are commonly inaugurated in rather prosperous times. The high costs which are ultimately normal are frequently not counted upon until the corpor-

ation gets into a period of general retrenchment. It might be better if the employer were advised to locate more pensioners at the start and, having found these pensioners, to aim at as complete a program of benefits from the inception as seems tenable at that time.

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In dealing with a continuous program of insurance or pensions, it is customary to make reports as of the end of successive calendar years. The entrants coming into a plan are assumed to come in evenly throughout the year, or, on the average, in the middle of the year. Thus, in the development of a reserve system there is apt to be what is sometimes called a "year-end value" which is somewhat different from the single premium applicable at the moment of entering the plan. In these studies instead of taking the single premium at the moment of entrance, it has been taken as of a half year later. The costs, therefore, are at variance with costs on the "exact moment of entrance" basis by an amount equal to one-half year's interest. This detail is mentioned since some of the values may not seem to check up with the tables used.