

THE FUNDING OF NEGOTIATED PENSION PLANS

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ABSTRACT

The long-term funding consequences of negotiated improvements in pension plans are examined. Particular emphasis is placed on the effects on both contribution rates and the overall funding position of the plan of such things as benefit increases to retirees, reductions in the average retirement age, economic events that affect the size of the active work force, and the interplay between the increases in pay and benefit rates and the other valuation assumptions. A simulation model is used to uncover the influence of each variable.

INTRODUCTION

ACTUARIES charged with determining costs for negotiated pension plans are faced with many problems that are unique to the profession. Entirely apart from the informed actuarial guesswork that is fundamental to pricing complicated and often confusing union demands and management counterproposals, the regular valuation of a negotiated plan that follows one of the major union patterns is a formidable task.

Over the years since the first major industrial union-negotiated plans were conceived in the late 1940s and early 1950s, the demands and counterproposals have grown in sophistication and complexity. Moreover, in nearly every round of negotiations, a new concept has shown its face as management and labor have grappled with the problems presented at the bargaining table. As a result, the major pattern pension plans today are extremely complicated.

The actuarial literature contains much work relating to approaching successfully the valuation problems presented by these plans. (For recent works of this nature see [1]–[8].) The purpose of this paper is not to add to this ample list. Instead, it is to focus on an issue that in many ways has not been given nearly as much attention as it deserves—the long-term funding trends of negotiated plans.

This paper attempts to shed some light on the following questions. What are the long-term funding consequences of consistently granting negotiated

increases in benefit levels to past retirees? What is the interplay between pay and benefit levels and the other valuation assumptions? What is the long-term effect of drastic reductions in the retirement age on both costs and the funded position of the plan? What is the effect on plan funding of economic events that periodically or permanently affect the size of the active work force?

A dynamic simulation model that mimics the typical negotiated plan from its infancy to full maturity is used to uncover the long-term trends. A measure of experience is added to the model to render its application more realistic.

The paper begins with a discussion of the technique, then follows with a separate discussion of each of the issues raised above.

TECHNIQUE

As was stated in the Introduction, the purpose of this paper is to describe in some detail the relationship between differential benefit levels, changes in retirement ages, benefit increases to past retirees, overall changes in the active population, and the funding position of negotiated plans. The analytical technique used involves a dynamic model that simulates the behavior of each element of pension cost over a fifty-year time span. By holding certain of the parameters of the model constant, while varying others, we can isolate and illustrate the specific contribution of each element that affects plan cost.

The idea behind the model is to capture the essential elements of a typical negotiated plan, from its infancy to full maturity, in a way that is not overly complicated. By rigidly adhering to a policy of simplicity, we hope to be able to "see the forest through the trees." The advantage of this approach is that the dominant effects of the important variables become obvious. The disadvantage is that, in order to apply the model to a real-world situation, it is necessary to estimate the effects of elements not taken into account. Based upon my experience with such plans, the relatively simple model described herein develops surprisingly accurate representations of reality. The effects of the missing elements are often quite obvious.

The general technique is to project an initially mature active work force with no retirees year by year in accordance with a fixed set of experience assumptions. For each year of the projection, actives are advanced in age, new entrants are added, retirees are augmented, withdrawals and deaths are removed, funds are accumulated at the assumed rate, and contribution rates are determined on the basis of an actuarial valuation for that year using the experience assumptions. Each fixed set of assumptions uniquely determines a string of fifty projections. By fixing all but one of the as-

sumptions, it is possible to compare two strings of projections, and the influence of the one assumption is illustrated. Because of the mass of data this process generates, it was decided to condense the results into graphs. For those who prefer a numerical approach, the Appendix contains the corresponding results.

Before the specific discussion of the model is begun, it is appropriate to explain the choice of fifty as the number of years in the simulations. As was stated previously, most negotiated plans in existence today were conceived in the early 1950s. Since many of these plans are funded using a frozen initial liability method with new thirty-year amortization periods initiated with each benefit increase, the initial liabilities will begin to be paid off as the 1980s unfold. Thus, it seemed appropriate that the starting year of the simulations should be capable of being conceptualized in two ways: either as the initial year of a newly negotiated plan or as the year 1950. With this dual role in mind for the start year, the end year was picked with a related objective: not only should it be reasonably distant so as to forecast the long-term effects of the tremendous plan design changes that have occurred since the 1950s, but also it should give a reasonable horizon for a new plan. It was felt that an endpoint twenty years distant from 1980 for a plan created in 1950 or fifty years distant from 1980 for a new plan would be both realistic and informative.

The model begins at the time $t = 0$ with an initially mature active worker population of l_t^a lives aged $x \geq 25$, with $l_t^a = 0$ for $x > 65$. Here, l_t^a is determined from two decrements—mortality of the 1951 Group Annuity Mortality Table for males set back one year, and withdrawal following T-3 of the *Actuary's Pension Handbook* by Crocker, Sarason, and Straight. These are the same decremental rates used in the Society's handbook on pension funding [9].

At $t = 1$ the retirement age is assumed to be 65, and at $t = n$ it is assumed to be r_n , where the latter is variable depending on the simulation. Post-retirement mortality is determined by the same 1951 male mortality table.

Negotiations are assumed to take place each year. The plan at time $t = n$ is assumed to have a single negotiated benefit for future retirees: a lifetime annuity of $\$(1 + k)^n B_0$ per annum payable at the beginning of the year in which age r_n is attained. Here $0 < k < 1$ and $B_0 > 0$ constant. The benefit $\$(1 + k)^n B_0$ is viewed as the normal retirement benefit at $t = n$. Thus, when $r_n < 65$ in some of the simulations, the model assumes that the full normal retirement benefit is payable at the earlier retirement age r_n . That is, no reductions are applied to the benefit in spite of the fact that it is payable before the normal retirement age. The reason for this particular construction will become clear when we discuss changes in retirement age.

There are no pre- or postretirement death benefits, no disability benefits,

and no benefits payable on account of termination other than by retirement.

The initial population is projected year by year using the same two decrements—mortality and withdrawal. All new entrants are assumed to join the plan at age 25. Of course, as long as $r_n = 65$, the new entrants amount to $1/25$. But in many of the simulations, either the retirement age is not age 65 or an assumption is made as to what the total size of the active work force will be. In these cases, just enough new entrants are added at age 25 to achieve the desired objective.

For $t \geq 1$, the participant population begins to include retired workers. Typically, the union will negotiate increases for past retirees as well as new benefit levels for future retirees. In order to simulate the impact of such increases, the benefit level of retirees is determined as follows:

At $t = n$, let the oldest retiree's age be w_n . The youngest retiree is aged r_n . The benefit amount of a retiree aged x , where $r_n \leq x \leq w_n$, is determined to be the greater of (1) his current benefit amount and (2) $[(1 + k)^n B_0 / (w_n - r_n)] [(w_n - x) + F(x - r_n)]$, where the variable F , $0 \leq F \leq 1$, is independent of n .

If, for example, $F = 0.8$, then the oldest retiree's benefit is the greater of the amount he is currently receiving and 80 percent of what the current active benefit level is. The benefit levels of retirees between the oldest and the youngest are graded upward from 80 percent to the full current active benefit for the youngest retirees.

In rational negotiations, the determination of the spread between the oldest retiree's benefit and the current active benefit level is not arbitrary. Rather, the bargainers agree on a spread that both sides can accept. A spread in the neighborhood of 10–30 percent of the active benefit level is quite realistic in many sets of negotiations.

The valuation method is entry age normal cost with frozen initial liability. Newly created unfunded liabilities are amortized over new thirty-year periods. Thus, over any rolling n -year period, $n \leq 30$, the past-service cost is the sum of n separate amortization payments. This particular funding method is in wide use as a result of the common provision in negotiated plans that provides for the separate amortization of newly created liabilities over new thirty-year periods.

The interest rate used in all valuations is 5 percent. Whereas one might think that this is overly conservative today, when one considers the dual conceptual role of the initial starting date, 5 percent may, in fact, be an overly liberal choice if it is viewed as the average valuation rate over the entire period 1950–99. (See, for example, [10].) In any case, as will be seen later, it is the relationship of the increases in the benefit rate to the interest rate that is important in these plans. Thus, I do not believe that the choice of 5 percent will nullify the basic results that flow from the simulations.

Before we begin the discussion of the results, one final word is needed on the presentation. Two items are key to the discussion of the costs of any pension plan: the level of contributions and the level of funds in relation to liabilities. In negotiated plans, it has been traditional to discuss the costs of the plan in "cents-per-hour" terms. This anachronistic notion expresses the cost of the plan by dividing the annual dollar cost by the estimated number of hours worked by the active work force in one year. Undoubtedly, expressing pension costs in cents-per-hour serves a useful purpose at the bargaining table to negotiators who are accustomed to thinking in such terms. But this concept is totally useless from the point of view of an actuary or other financial professional trying to uncover the trends in pension costs in such plans. The only way to view the cost trends in negotiated plans is to recognize that the plans are generally bargained in such a way as to keep replacement rates of benefit levels in line with previous negotiations. The key difference between a negotiated plan and a final-pay plan is that, in the latter case, an actuary can anticipate and pre-fund liabilities that emerge as a result of pay increases in the future, whereas in the former case he must continually aim at a new target and adjust his funding level accordingly. In either case, expressing the costs of the plan as a percentage of payroll is a valid way of measuring long-term costs.

In this discussion, all costs are expressed as a percentage of payroll. The assumption is that the average pay for each active employee will be $\$(1 + j)^n P_0$ per annum at time $t = n$, where $0 \leq j \leq 1$ and $P_0 > 0$ is a constant. Given that the pay rates of workers covered by negotiated plans typically are very closely dispersed about the mean, this is a realistic assumption.

All costs are normalized by dividing the cost as a percentage of payroll at $t = n$ by the cost as a percentage of payroll at $t = 1$. This convention simplifies the discussion by canceling out the constants P_0 and B_0 , allowing us to compare two periods more conveniently. In the tables of the Appendix we assume that $P_0 = B_0 = 1$.

Table I describes the parameters that uniquely determine the simulations used in this discussion.

BENEFIT INCREASES FOR RETIREES

Intuition tells us that if the union consistently negotiates increased benefit levels for future retirees that are in step with increases in pay and at the same time negotiates increases for past retirees that are related to the increases for future retirees, then the cost of the plan must have an upward bias. This notion is borne out by the first two simulations.

To illustrate, we compare cases IA and IIIA in Figure 1. The only difference between the two is that, in the former, $F = 0.8$ (i.e., a 20 percent "spread"), whereas in the latter $F = 0$ (i.e., no increase to retirees). In

both cases, the replacement rate for future retiree benefit levels is assumed to remain constant, but the increases in pay and benefit levels are assumed to be exceeded by the valuation interest rate. Further, in both cases, the retirement age is assumed to remain static.

As can be seen from Figure 1, in both cases the most significant event that affects long-term pension costs is the exhaustion of the initial past-

TABLE I
PARAMETERS DEFINING THE SIMULATIONS

Simulation	Interest Rate	Pay Scale (j)	Benefit Scale (k)	Fraction of Benefit to Oldest Retiree (f')	Retirement Age Assumption
IA	5%	3%	3%	80%	65
IB	5	5	5	80	65
IIA	5	5	3	80	65
IIB	5	5	3	0	65
IIIA	5	3	3	0	65
IIIB	5	5	5	0	65
IVA	5	3	3	80	65, $1 \leq n \leq 10$ 64, $11 \leq n \leq 19$ 63, $20 \leq n \leq 28$ 62, $29 \leq n \leq 50$
IVB	5	5	5	80	Same as IVA
VA	5	3	3	80	65, $1 \leq n \leq 10$ 64, $11 \leq n \leq 13$ 63, $14 \leq n \leq 16$ 62, $17 \leq n \leq 19$ 61, $20 \leq n \leq 22$ 60, $23 \leq n \leq 25$ 59, $26 \leq n \leq 28$ 58, $29 \leq n \leq 50$
VB	5	5	5	80	Same as VA

NOTES TO TABLE I

1. Except as noted below, for each year of the simulation enough new hires are added so that the active work force remains constant.

2. In subsequent references to these simulations, an asterisk (*) following the simulation number will indicate that the active work force varies as follows: (a) in years 5, 6, 10, 11, 15, 16, 20, 21, 25, and 26, no new hires are added; (b) in all other years, enough new hires are added to bring the active work force up to its original level.

3. A double asterisk (**) added to a simulation number will indicate that the active work force varies as follows: Let W_n be the total active work force in year n . Then

$$\begin{aligned}
 W_n &= W_1, & 1 \leq n \leq 20 \\
 &= W_1[1 - 0.025(n - 20)], & 21 \leq n \leq 29 \\
 &= 0.75W_1, & 30 \leq n \leq 50.
 \end{aligned}$$

Only enough new hires are added in year n to bring the active work force up to W_n .

service liability. In case IIIA this event brings with it a 33 percent drop in contributions, whereas in case IA the drop is 28 percent.

From IA it is clear that retiree increases introduce a gradually increasing upward bias in plan costs. After fifty years in these simulations, the upward bias stabilizes in costs that are approximately one-third higher in case IA than in case IIIA, where no retiree increases are granted. However, in spite of this upward bias, in both cases the long-term cost stabilizes at a level that is lower than it was in the initial year. Thus, the first pair of simulations demonstrates that increases to retirees significantly increase long-term costs and also act to diminish the importance of exhausting past-service liabilities.

The simulations displayed in Figure 2 compare cases IIA and IIB. Here we keep all elements the same as in the previous pair of simulations, except we assume that pay increases consistently keep up with the valuation rate and that both exceed benefit increases.

As one would expect under such assumptions, the combination puts costs as a percentage of payroll on a definite downward trend. Even the costs associated with retiree increases are not enough to make the slope of the curve for IIA positive. But the higher payroll acts to amplify the importance of exhausting the initial past-service liability somewhat when we compare these two simulations with those in Figure 1.

If this discussion is to have any application at all to real-world situations, it must be realized that the previous two pairs of simulations do not depict

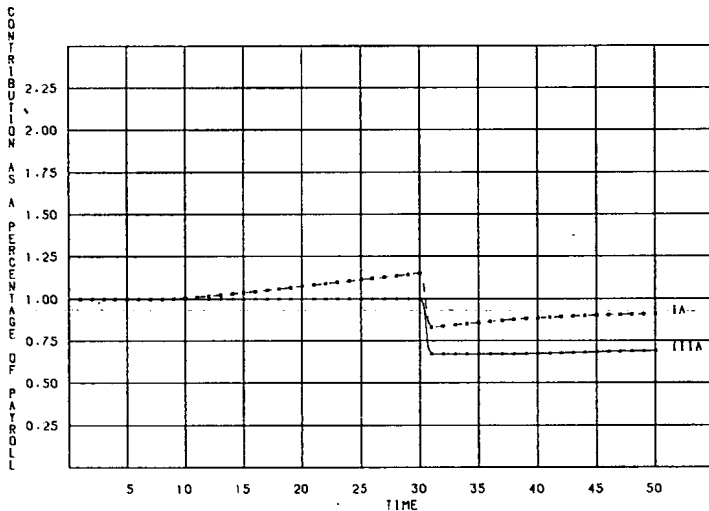


FIG. 1.—Contribution as a percentage of payroll over time: effect of retiree increases in cases where interest rate exceeds pay and benefit increases.

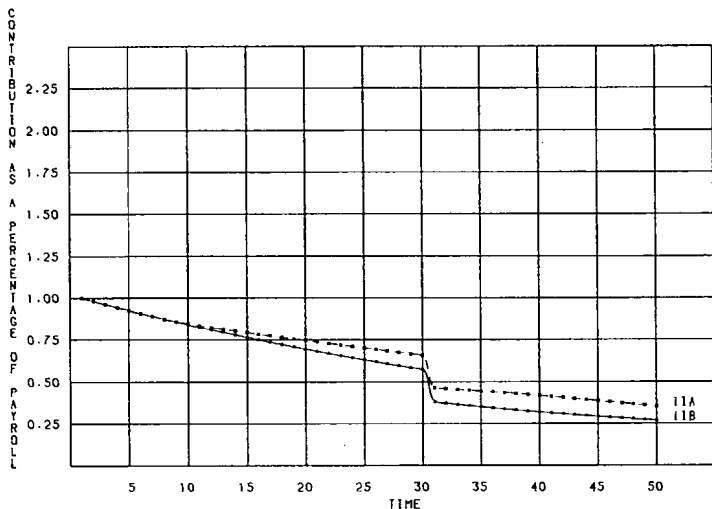


FIG. 2.—Contribution as a percentage of payroll over time: effect of retiree increases in cases where interest rate and pay increases exceed benefit increases.

very well the growth of the major industrial union plans since their inception in the early 1950s. Entirely apart from their development of subsidized early retirement and other benefit liberalizations, the major industrial union plans have experienced a very rapid growth in benefit rates over the years since 1950.

In Table 2 we compare the growth in wages with the growth in pension benefits for three large industrial groups: steel, automobile, and rubber workers. The wage figures shown illustrate what the average industry-group worker has earned. Of course, employees of specific firms within the industry group did not earn exactly the wage shown, but for purposes of illustrating how the wages have grown compared with how the pension benefits have grown in these industries, this presentation is meaningful. Similarly, the pension benefits shown for new normal retirements with thirty years of service are illustrative of only one firm within the industry group. But, because the industry groups typically have followed pattern-setting pension plan bargaining over the years, the benefits shown are indicative of the general level of benefits available in the industry as a whole. Finally, the hypothetical replacement ratios calculated in the last three columns are not necessarily indicative of the replacement ratios within specific firms. Rather, they illustrate how the general level of industry pensions has grown in relation to pay.

TABLE 2

COMPARISON OF PRODUCTION WORKER AVERAGE EARNINGS AND NORMAL RETIREMENT BENEFITS, 1950-80, FOR THREE MAJOR
INDUSTRY-GROUP NEGOTIATED PENSION PLANS

YEAR	INDUSTRY GROUP PRODUCTION WORKER ANNUAL AVERAGE WEEKLY EARNINGS			REPRESENTATIVE FIRM'S HIGHEST PLAN-PROVIDED NORMAL RETIREMENT BENEFIT FOR RETIREMENT WITH 30 YEARS OF SERVICE IN CALENDAR YEAR			PERCENTAGE OF AVERAGE MONTHLY PRODUCTION WORKER EARNINGS REPLACED BY REPRESENTATIVE FIRM'S NORMAL RETIREMENT BENEFIT		
	SIC 301 Tires and Inner Tubes	SIC 331 Blast Furnace and Basic Steel Products	SIC 371 Motor Vehicles and Equipment	Firestone Tire and Rubber Co. (URW)	United States Steel Corp. (USW)*	Ford Motor Co.† (UAW)	Firestone Tire and Rubber Co. (URW)	United States Steel Corp. (USW)	Ford Motor Co. (UAW)
1950	\$ 72.98	\$ 67.95	\$ 74.85	\$ 45.00‡	\$ 45.00‡	\$ 45.00‡	14%	15%	14%
1955	101.82	96.80	99.84	54.00	55.00	67.50	12	13	16
1960	116.62	116.13	115.21	72.20	71.10	72.23	14	14	14
1965	158.06	140.90	147.63	97.50	71.10	127.50	14	12	20
1970	179.73	166.40	170.07	232.50	195.00	172.50	30	27	23
1975	234.02	274.13	259.53	300.00	352.50	360.00	30	30	32
1980	344.34§	438.17§	369.51§	450.00	487.50	504.00	28	26	31

SOURCES.—For the wage data see [12]–[15]. For the benefit data see [16]–[23].

* The amount shown is the plan's minimum benefit.

† Where benefit amounts are dependent on the benefit class code, class B is used.

‡ The actual benefit amount was \$100 integrated with social security. The amount shown is the plan-provided portion with an assumed \$55 social security benefit. This social security assumption was common in other negotiated plans of 1950.

§ Average of the months January to June.

It is commonly believed that, in the earliest days of their history, the major union pension plans made significant improvements in benefit levels. As can be seen from Table 2, this was not, in fact, the case. Actually, the replacement ratios remained relatively constant until the mid-1960s. It was during these heady days of general economic prosperity that the largest real gains in pension benefit levels were achieved. This should be a reminder that negotiated plans never operate in a vacuum; they always reflect the general economic conditions in existence at the time of bargaining.

In Table 3 we compare the average annual rates of increase in benefits with the rates of increase in wages for the three decades since 1950. Three significant results can be seen from this table. First, the last two columns illustrate what tremendous real gains in pension benefit levels were achieved in the 1960s. Over that decade, annual rates of increase in benefits for new normal retirements exceeded annual rates of increase in wages by anywhere from 5.1 to 8.0 percent.

Second, the general flatness of the economy since the end of the Vietnam War has been reflected in the rates of increase for the decade of the 1970s. With the exception of the automobile group, wages have outpaced benefits. In fact, the same would be true for the automobile group, were it not for the coincidence that the last contract was bargained at the end of 1979, at the end of a six-year pension agreement. The annual rates of increase would have been significantly lower if the benefit rates under the 1973-79 automobile pension contract had been used in this table. Nonetheless, the fact remains that, over the entire thirty-year period, benefits increased anywhere from 1.9 to 2.9 percent per year faster than wages.

Third, and most significantly, benefits and pay have increased at average annual rates in excess of the valuation interest rate used by the majority of actuaries during the periods shown. Although historical data regarding valuation assumptions are sketchy at best, some idea of the rates used by actuaries over the years can be obtained from an extract (Table 4) of a table of Fisher's [10]. When these figures are compared with the rates of increase in benefits and pay, it is apparent that those average rates of increase have outpaced valuation interest rates in each decade shown for each industry group illustrated.

Surely, therefore, a much more realistic scenario would assume that annual rates of increase in benefits equal or exceed both pay increases and the valuation interest rate. Recognizing, however, that the magnitude of the increases shown in Table 3 is due to a variety of influences that are not likely to be repeated in the years to come, the assumptions used for the more realistic simulations simply assume that annual rates of increase in both pay and benefits exactly match the valuation interest rate.

TABLE 3

ANNUAL RATE OF INCREASE IN PRODUCTION WORKER AVERAGE EARNINGS AND NORMAL RETIREMENT BENEFITS FOR SELECTED PERIODS, 1950-80, FOR THREE MAJOR INDUSTRY-GROUP NEGOTIATED PENSION PLANS

PERIOD	AVERAGE ANNUAL RATE OF INCREASE IN INDUSTRY-GROUP PRODUCTION WORKER ANNUAL AVERAGE WEEKLY EARNINGS			AVERAGE ANNUAL RATE OF INCREASE IN REPRESENTATIVE FIRM'S HIGHEST PLAN PROVIDED NORMAL RETIREMENT BENEFIT FOR NEW RETIREMENTS WITH 30 YEARS OF SERVICE AT THE BEGINNING AND END OF PERIOD			THREE INDUSTRY GROUPS: RANGE OF EXCESS OF ANNUAL RATES OF INCREASE IN BENEFITS OVER WAGES	
	SIC 301 Tires and Inner Tubes	SIC 331 Blast Furnace and Basic Steel Products	SIC 371 Motor Vehicle and Equipment	Firestone Tire and Rubber Co. (URW)	United States Steel Corp. (USW)	Ford Motor Company (UAW)	Lowest	Highest
1950-60	4.8%	5.5%	4.4%	4.8%	4.7%	4.8%	0 %	0.8%
1960-70	4.4	3.4	4.0	12.4	10.6	9.1	5.1	8.0
1970-80	7.4	10.2	8.1	6.8	9.6	11.3	-0.6	3.2
1950-80	5.5%	6.4%	5.5%	8.0%	8.3%	8.4%	1.9%	2.9%

TABLE 4

MOST COMMON INTEREST RATE ASSUMPTION
AND RANGES

Year	Most Common (Average) Assumption	Average Range
1955	2.82%	2.53%-3.35%
1965	3.71	3.28 -4.38
1975	5.66	4.83 -6.61

The comparison of cases IB and IIIB in Figure 3 illustrates the ratcheting effect that this combination of assumptions produces on plan costs. Once again, the exhaustion of the initial past-service liability is a dominant event in the cost history. Of greater importance, however, is the fact that in case IB, where retiree increases are assumed, the cost savings realized by paying off the initial past-service liability are more than canceled by the higher level of benefit increases. Moreover, whereas in case IA costs dropped 28 percent in the thirty-first year, in case IB the drop is only 14 percent. Similarly, even in the absence of retiree increases, in case IIIA costs dropped 33 percent in the thirty-first year, whereas in case IIIB the drop is only 17 percent.

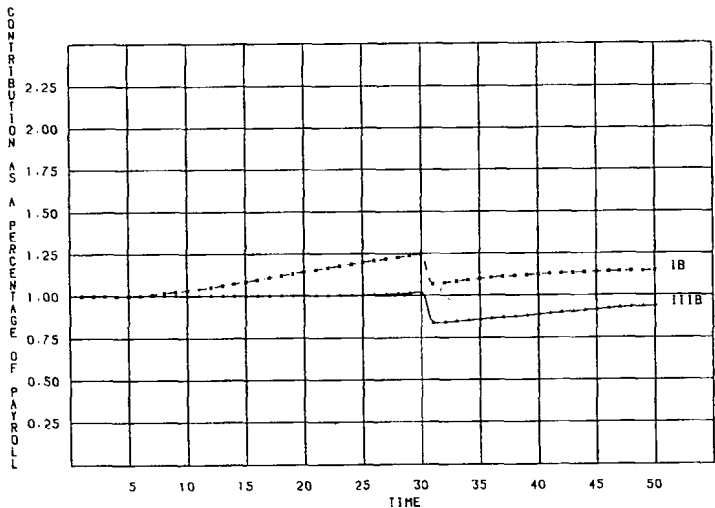


FIG. 3.—Contribution as a percentage of payroll over time: effect of retiree increases in cases where interest rate matches pay and benefit increases.

In these simulations we see the first signs of a disturbing pattern in the funding of these plans: when replacement ratios for active-employee benefits do not decline and past retirees are granted increases that are related to the active benefit level and the rate of increase in benefits is matched by the valuation interest rate, the result is costs that not only have an upward bias but also diminish the importance of exhausting past-service liabilities.

We now introduce a new element. Up to this point all simulations have utilized a static retirement age. We now allow the retirement age to vary. From this point forward we assume that retiree increases are consistently granted and $F = 0.8$. As was stated earlier, this implies a 20 percent spread between the benefit level of the oldest retiree and the benefit level for future retirees.

We also assume that the replacement rate for future retiree benefit levels remains constant, that is, $j = k$. In cases of long-established bargaining relationships, neither management nor the union is likely to deviate much from this principle when negotiating new benefit levels. Therefore, this does not seem to me to be an unrealistic assumption.

CHANGES IN THE RETIREMENT AGE

Over the years since 1950, negotiated plans have introduced a variety of plan provisions that have had a significant and seemingly permanent effect on the average retirement age. The plan provisions that impact on the retirement age today are very rich in their diversity—ranging from the very simple concept of providing unreduced benefits at a certain age (typically age 62) with subsidized reductions for earlier retirement, through the various “point” systems (e.g., when age plus service equals at least 85, retirement is permitted, with either actuarial reductions, subsidized reductions, or no reductions at all), through the “thirty-and-out” type of retirement plan (e.g., retirement at any age with thirty years of service, often with unreduced lifetime benefits, either with or without social security supplements).

As these provisions have been introduced into the negotiated-plan universe, it has become apparent that they bring with them a certain predictable behavior on the part of the union membership. Typically, the union membership is aware of the goals of its bargainers well in advance of negotiations. Usually, special prebargaining council meetings are held to lay out broad outlines for the bargainers to follow. In these council meetings, vaguely defined bargaining goals are expressed as a prelude to the actual preparation of specific demands. Word spreads rapidly among the membership that a specific pension demand is high on the priority list—say, for example, a new liberalization of the early retirement eligibility provisions, or a substantial

increase in the existing benefit levels. Having become aware that the bargainers are likely to bring back to them a retirement package that is significantly better than what they already have, those near retirement are likely to wait until a new contract is negotiated. Once a new contract is signed, a surge of retirements follows in the contract year that contains the most advantageous improvement. If, as is often the case, there are several improvements during the contract term, this same scenario repeats itself over the entire term.¹

As the large industrial unions began the process of liberalizing their early retirement programs in the mid-1960s, this pattern was repeated again and again during each set of negotiations. However, something else was happening at the same time. Not only was there a surge of retirements as a result of active employees deferring a retirement decision under the terms of the existing plan, but also the plans introduced new and even more liberal early retirement provisions. Thus, joining the surge was a new group of retirees not previously eligible. The net effect was twofold: while the number of retirements moved in fits and starts, the average retirement age began to decline.

When one attempts to simulate the impact on plan costs of a drop in the average retirement age, it becomes clear that in order to do so properly both of the aforementioned effects must be included. This is accomplished through the simple expedient of assuming that in each valuation year the actuary has enough information to enable him to change the average retirement age as needed. Thus, in the model, when the retirement age r_n is, say, age 65, and the retirement age r_{n+1} is age 64, then, not only are costs for the active participants valued assuming the new and lower retirement age, but, in the valuation at $t = n + 1$, the retirees are augmented by I_{64}^n as well as I_{65}^n .

As previously described in Table 1, two retirement age scenarios were selected: the gradual scenario (IV) assumes that the average retirement age drops uniformly three years in thirty, and the rapid scenario (V) assumes that the average retirement age drops one year in each three-year period, beginning with the eleventh year and ending with the twenty-ninth year—a total of seven years in thirty. In both cases, the retirement age is assumed to stabilize for the remainder of the simulation. On the basis of my experience with plans having heavily subsidized and supplemented early retirement, scenario V is not at all unrealistic if the benefit levels replace a large enough proportion of preretirement pay. (See pp. 698–704 of [1].)

¹ This process has been illustrated to a certain extent. See pp. 698–704 of [1].

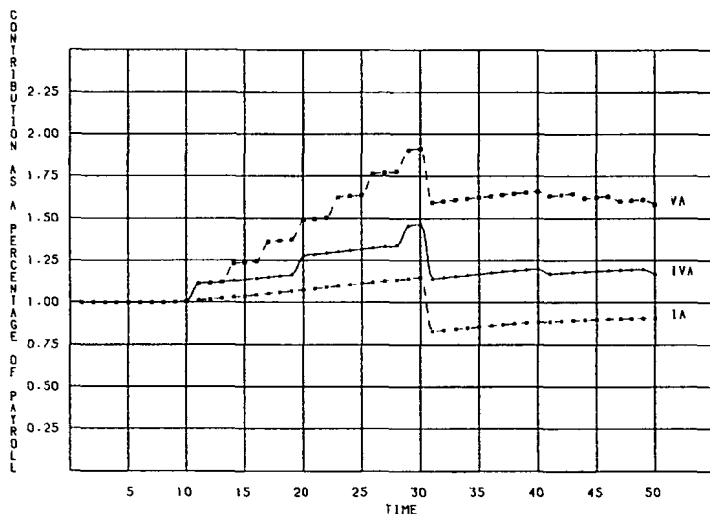


FIG. 4.—Contribution as a percentage of payroll over time: effect of changes in retirement age in cases where interest rate exceeds pay and benefit increases and retiree increases maintain a 20 percent spread.

In the previous discussion describing the model, it was stated that the benefit level set for future retirees at any valuation date $t = n$ is the unreduced benefit $(1 + k)^n B_0$. Of course, not all retirees in negotiated plans receive unreduced benefits. In fact, in most plans, unless some other condition is satisfied (e.g., thirty years of service or 85 points²) retirement as early as, say, age 58 brings with it reduced benefits. In the simulations, however, no attempt is made to model pre-social security early retirement supplements. It was decided that, for the sake of simplicity, we would assume that all those who retire at a certain age are entitled to unreduced benefits. In fact, the presence of supplemental allowances would act to *increase* the costs we show.

Figure 4 displays the results of the simulations, based on the assumption that the valuation rate exceeds the rate of increase in both pay and benefits. To anyone who has charted the historical pattern of the costs of negotiated plans, the upward-marching staircase is a familiar sight. In both cases IVA and VA, the change in retirement age produces the corresponding increase in costs.

² Age plus years of service totaling 85.

The earliest steps are the most costly. The first increases costs by 10.4 percent, whereas the last increases costs by 8.5 percent in case IVA and by 7.1 percent in case VA. On the down side, the exhaustion of the initial past-service liability once again plays a significant role. Also, as the past-service liability for each step is paid off, there is a corresponding reduction in cost. But, because pay and benefit levels rise, there is a much smaller reduction in cost (in terms of percentage of payroll) than was initially incurred. After fifty years, costs stabilize in case VA at a level 58 percent higher, and in case IVA at a level 17 percent higher, than when they started.

The comparison of these values and the stabilized IA costs is interesting. It demonstrates that, when the interest rate exceeds both pay and benefit level increases, long-term costs are increased by 8.7 percent for each of the first three years' drop in the average retirement age, and by 7.9 percent for each of the next four years' drop in the average retirement age.

When we make what I consider to be the more realistic assumption that pay and benefit increases match the valuation interest rate, we see (Fig. 5) a similar picture. However, the steps going up are steeper—especially for the first years of drop in retirement age. By the thirtieth year, IVB costs peak at 56 percent higher than where they began, whereas IVA costs peak

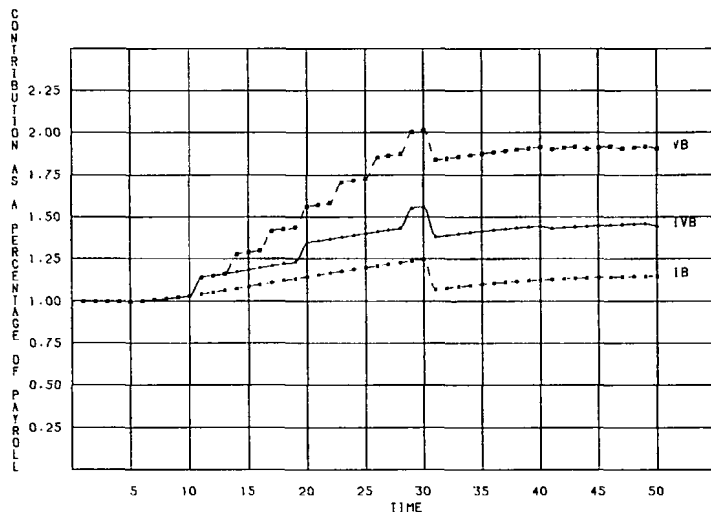


FIG. 5.—Contribution as a percentage of payroll over time: effect of changes in retirement age in cases where interest rate matches pay and benefit increases and retiree increases maintain a 20 percent spread.

at 46 percent higher. Also, VB costs peak at roughly 100 percent higher than where they began, whereas VA costs peak at 91 percent higher. Disturbingly, the exhaustion of the initial past-service liability is rendered almost meaningless—reducing costs by only 9 percent in case VB.

Thus, once again we see that the long-term cost effect of such levels of benefit increase is a double ratcheting: not only raising the long-term cost but also reducing the downside effects of exhausting past-service liabilities.

CHANGES IN THE ACTIVE WORK FORCE

Up to now, we have made the unrealistic assumption that the total work force remains constant for the entire fifty-year period. Only very rarely will this be the case. Typically, the union membership is the first to feel the effects of a general economic downturn. If one were to examine the service distribution of a typical large union plan today, one would see a graphical illustration of this point. Each recession has made its mark on the service distribution, in the form of reduced numbers of participants at certain service combinations as a result of reduced hiring levels during recessions. Therefore, the raw material from which we determine our costs for active employees is in a very real sense an image of the economic events of the preceding forty or so years. Obviously this must have some effect on costs.

To simulate these effects, two assumptions were made with regard to the active work force. Both are found in the notes following Table 1. The first, labeled *, is designed to simulate in a crude fashion the five economic downturns in the period 1950–79. It is simply assumed that in each five-year period, beginning with the period 5–9 and ending with the period 25–29, there are no new hires for two years. In the third year, new hires are added to bring the work force up to its “pre-recession” level. In the second case, labeled **, it is assumed that the firm enters into a prolonged downturn in the twentieth year, which gradually and permanently reduces the work force by 25 percent. In both cases, the work force is assumed to stabilize at the resulting level for the remainder of the simulation.

In Figures 6 and 7, we illustrate case * with the two sets of assumptions that we have made regarding the relationship of the valuation interest rate to the level of benefit and pay increases. As can be seen from the figures, periodic hiring freezes have no apparent long-term effect as long as the population returns to its original size. Both figures are substantially the same as their counterparts in Figures 4 and 5. It is clear, however, that the cost of the plan does vary considerably during the years of the periodic hiring freezes. This variability is amplified by the introduction of retirement age changes. It seems that the only lesson to be learned from this is that

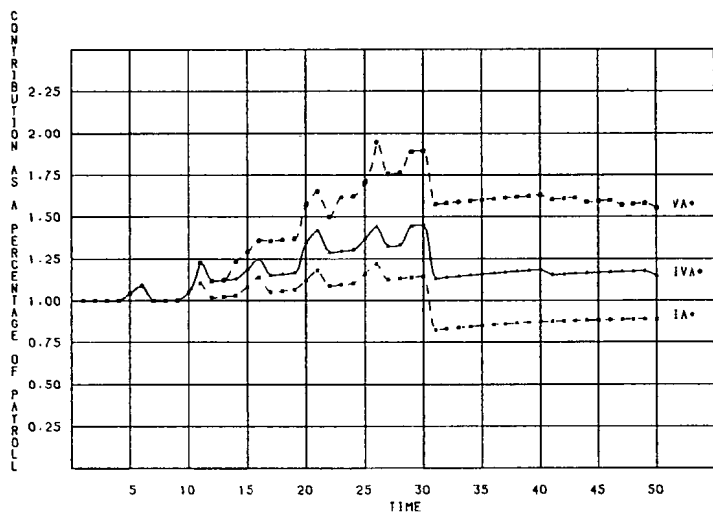


FIG. 6.—Contribution as a percentage of payroll over time: effect of periodic economic downturns in cases where interest rate exceeds pay and benefit increases and retiree increases maintain a 20 percent spread.

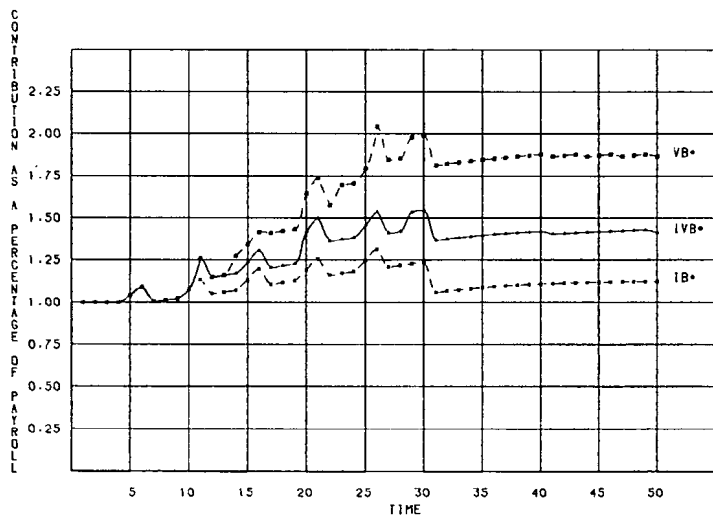


FIG. 7.—Contribution as a percentage of payroll over time: effect of periodic economic downturns in cases where interest rate matches pay and benefit increases and retiree increases maintain a 20 percent spread.

bargainers should be cautious of making judgments about pension costs based on just one point in time. Rather, the trend should be determined to smooth out the effects of present as well as past economic downturns on costs.

In Figures 8 and 9, we illustrate the effects of the assumption **. As can be seen from the displays and a comparison with Figures 4 and 5, the effect on costs for the period during which the retirement age is falling is a very steeply increasing contribution rate. Of course, once the past-service liabilities begin to be paid off, the decline is on a steeper slope than in Figures 4 and 5. But, significantly, the added burden of retirees in relation to the number of active employees causes the long-term cost in both Figures 8 and 9 to stabilize at a level about 18 percent higher than in Figures 4 and 5. Therefore, as would be expected, the permanent contraction of the work force has a long-term cost effect, regardless of the retirement age assumption.

ACTIVE-TO-RETIREE RATIO

As was seen in case **, overburdening a negotiated plan with retirees raises the long-term costs significantly. It does not take a simulation model to convince an actuary that this will be the case.

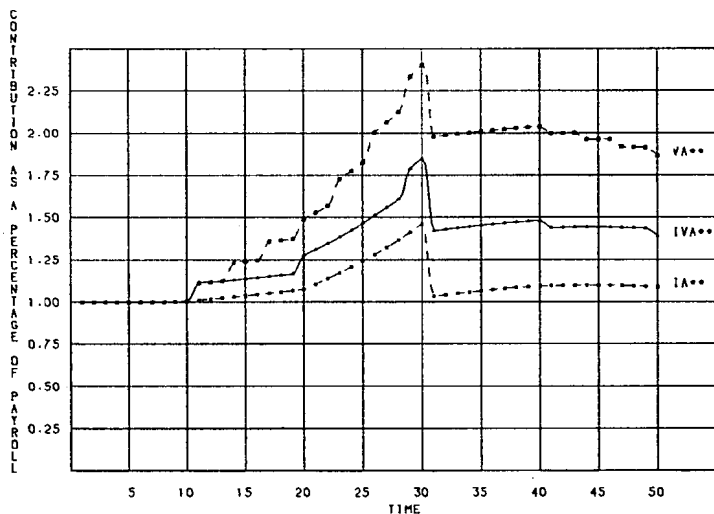


FIG. 8.—Contribution as a percentage of payroll: effect of a permanent 25 percent reduction in work force in cases where interest rate exceeds pay and benefit increases and retiree increases maintain a 20 percent spread.

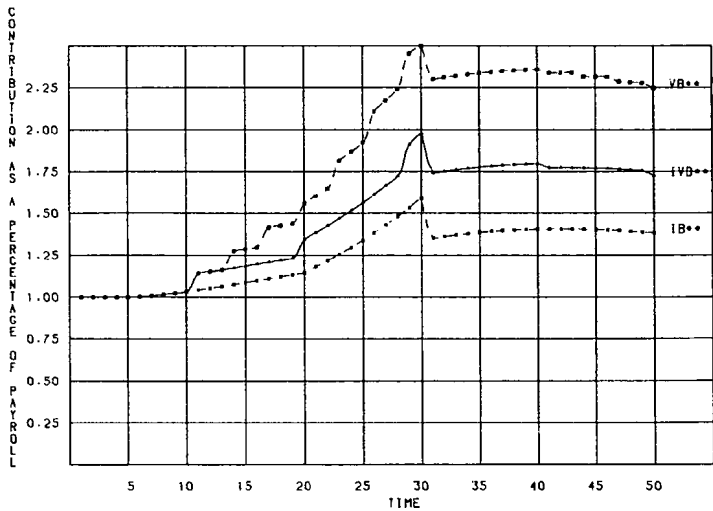


FIG. 9.—Contribution as a percentage of payroll: effect of a permanent 25 percent reduction in work force in cases where interest rate matches pay and benefit increases and retiree increases maintain a 20 percent spread.

This aspect of negotiated-plan funding has presented bargainers on both sides of the table with very considerable problems. In recent times, a complicating factor in many negotiations has been the very small active-to-retiree ratio, which makes the costs of the pension plan an overriding concern—outweighing even wages in importance. In fact, the pension costs of some firms in this situation have become so extraordinary that even the fundamental decision regarding the firm's existence hangs in the balance.

It seems appropriate, therefore, that we examine how the retiree population grows in negotiated plans. Figures 10–12 display the active-to-retiree ratio under the three sets of economic assumptions we have considered. As can be seen from the figures, the ratio declines very rapidly for the first ten years of plan operation. In case I (IA and IB), the precipitous drop slows down over the next fifteen years and then reaches its equilibrium value. The equilibrium value is deferred in cases IV and V until the thirtieth year. Thus, in a mature-plan situation, the active-to-retiree ratio stabilizes soon after the retirement age stabilizes.

Significantly, the first three-year drop in the average retirement age lowers the ultimate ratio by 18 percent. The next four-year drop lowers it by an additional 23 percent. In case **, the effect of the permanent work force contraction is to lower the ratios of I, IV, and V by 25 percent—the assumed

drop in the active work force by the end of the simulation. In case *, we see that during the period of hiring freeze the ratio drops as the active work force drops. The gaps that these hiring freezes leave in the work force show up years later as gaps in the number of new retirements. Thus, at the end of the simulation, we see the ratio rising for brief periods. This is another

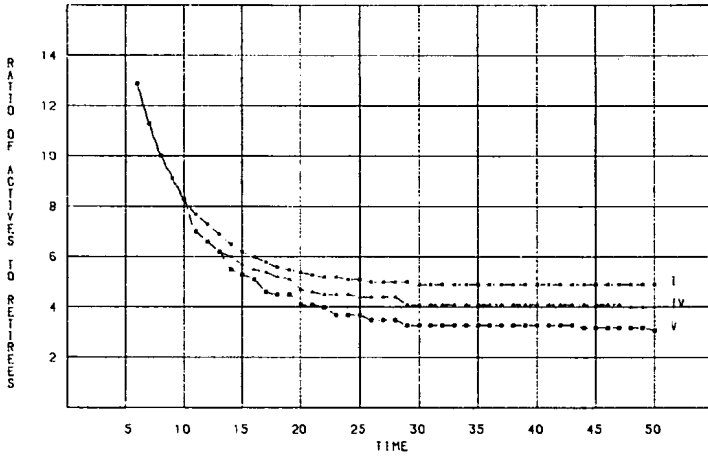


FIG. 10.—Ratio of active employees to retirees: constant work force; three retirement age scenarios.

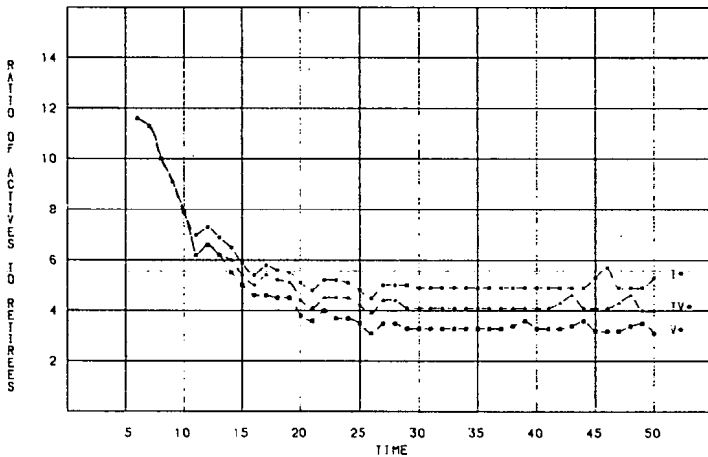


FIG. 11.—Ratio of active employees to retirees: periodic economic downturns; three retirement age scenarios.

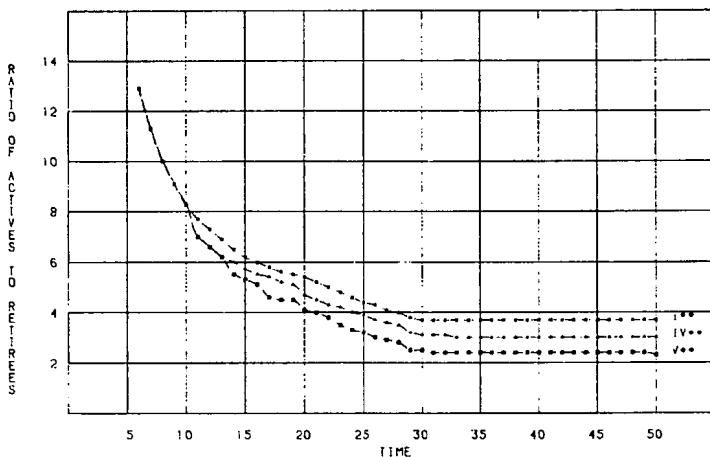


FIG. 12.—Ratio of active employees to retirees: permanent 25 percent reduction in work force; three retirement age scenarios.

indication that bargainers should be wary of using data based on a single point in time. It would be more prudent to determine the trend before making predictions.

PROGRESS OF FUNDING

Funded Ratios

The term "funded ratio" means, in this instance, the ratio of the accumulated assets at a point in time to the sum of the accumulated assets and unfunded liabilities. Figures 13–15 display the progress of these ratios for the three sets of economic assumptions we have considered. It is apparent from a comparison of these figures that the funded ratio is relatively insensitive to changes in the active work force. The exceptional case ** implies that long-term reductions in work force do have a slight downward impact on funded ratios. Of perhaps more interest is the observation that the funded ratio, although it can vary considerably as the retirement age drops, tends to an equilibrium position that is independent of the ultimate long-term retirement age.

The only variable of importance seems to be the long-term relationship between the valuation interest rate and increases in benefit level. In the A cases (IA, IIA, etc.), the equilibrium funded ratio tends to be in the neighborhood of 60 percent, whereas in the B cases, it tends to be in the neighborhood of 45 percent. Thus, independent of the retirement age assumption,

each percentage point difference between the valuation interest rate and the long-term rate of increase in benefits adds 7.5 percentage points to the ultimate funded ratio.

This result has serious implications, one of them being that, short of increasing the interest assumption or moving to an aggregate cost method or otherwise shortening funding periods, there is nothing the actuary can do to improve the long-term funding position of the plan as long as the

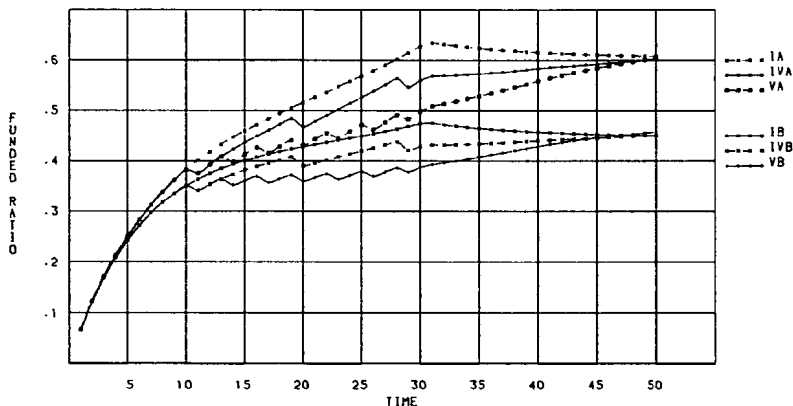


FIG. 13.—Funded ratios: constant work force: two scenarios on interest rate, pay, and benefit increase relationships: three retirement age scenarios.

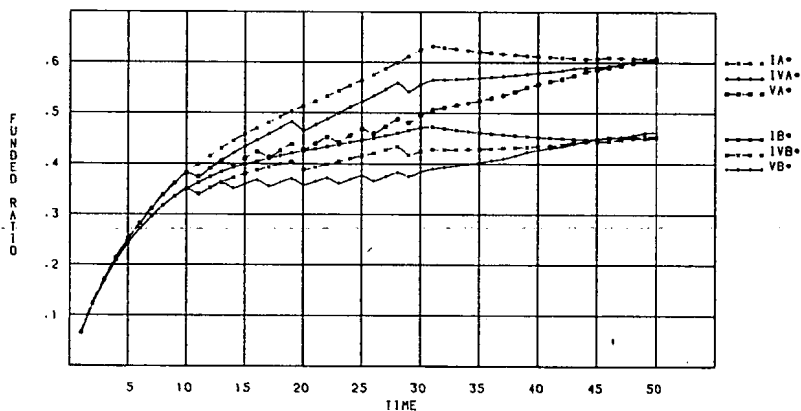


FIG. 14.—Funded ratios: periodic economic downturns: two scenarios on interest rate, pay, and benefit increase relationships: three retirement age scenarios.

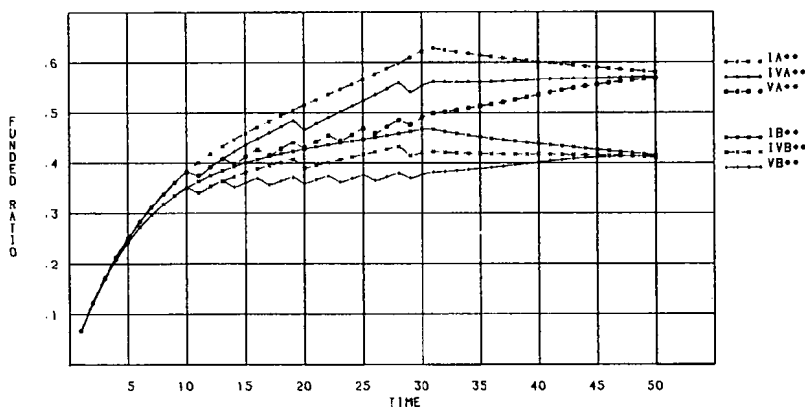


FIG. 15.—Funded ratios: permanent 25 percent work force reduction; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios.

bargainers bring back from the negotiations benefit levels that are increasing at the same rate as the valuation interest rate. The fact is that, in many plans, rates of increase in benefit levels have exceeded the valuation interest rate. Therefore, plan sponsors are going to have to adjust to low funded ratios unless they decide to accelerate funding by one of the methods described above.

Advance Funding Ratio

As Hanson has correctly pointed out in [12], the funded ratio can rise over the years even though there has been no funding for active employees. Accordingly, he suggests the device of considering the advance funding ratio (AFR), where

$$\text{Advance funding ratio} = \frac{\text{Total assets less retired liabilities}}{\text{Total liabilities less retired liabilities}}$$

Thus, a negative AFR indicates that the plan's assets are no longer sufficient to cover retired liabilities. In Figures 16–18, we illustrate the AFR for the three sets of economic assumptions we have used.

As can be seen from the figures, the AFR converges much more slowly than the funded ratio. In all three figures it appears that in the A cases the

AFR will tend to a level of approximately 0.2, whereas in the B cases the AFR will tend to a level of approximately zero. Thus, each percentage point difference between the valuation interest rate and the long-term rate of increase in benefits adds 10 percentage points to the AFR.

The AFR is also seen to be much more sensitive to changes in the retirement age than is the funded ratio. Whereas declines in the retirement

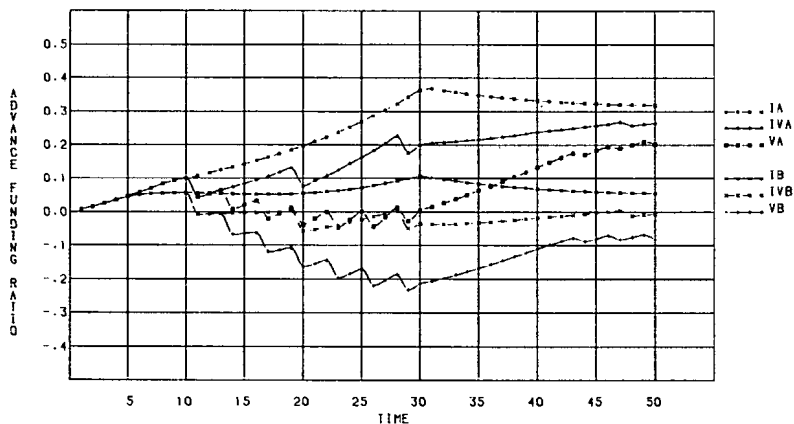


FIG. 16.—Advance funding ratio: constant work force; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios.

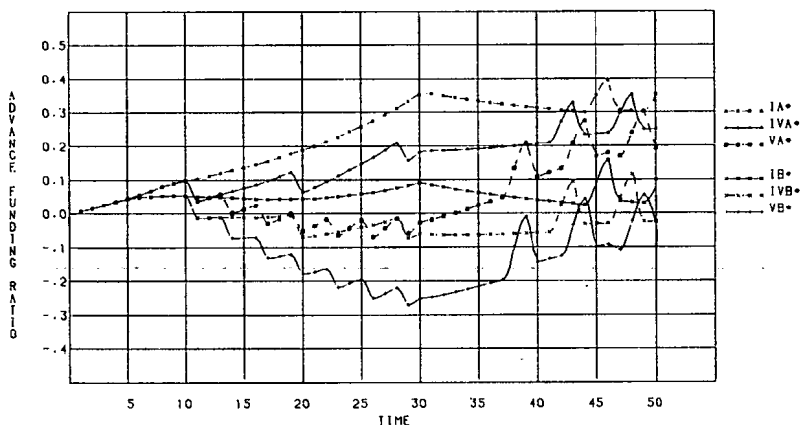


FIG. 17.—Advance funding ratio: periodic economic downturns; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios.

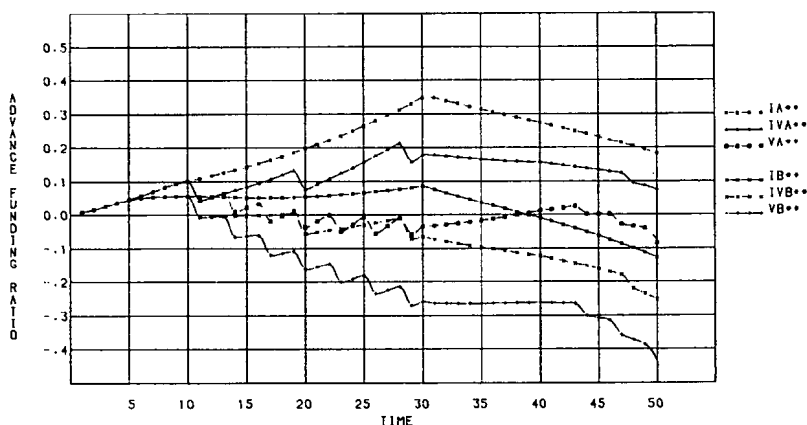


FIG. 18.—Advance funding ratio: permanent 25 percent work force reduction; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios.

age caused the funded ratio to stabilize, they actually cause the AFR to decrease.

The examples used by Hanson in [12] illustrate UAW thirty-and-out plans whose assets are exceeded by retired liabilities even though the plans faithfully followed thirty-year funding practices. These examples appear to be more the rule than the exception. When plans follow thirty-year funding practices, the built-in bias is to follow a course that leads to no funding whatsoever for active liabilities.

Finally, economic events that result in changes in the active population have a much more noticeable effect on the AFR than on the funded ratio. In the * cases, the hiring freezes have no noticeable effect on the AFR until they show up as gaps in the numbers of retirees for certain periods. These gaps bring about large variations in the AFR. Thus, plan sponsors should be suspicious of any dramatic improvements in the AFR—they may be short-lived. In the ** cases, the AFR is very definitely put on a downward trend by the increased burden of retirees. No funding for actives seems to be the rule in such cases.

SHORTER FUNDING PERIODS

The foregoing analysis indicates that, if thirty-year funding is used for all benefit increases, the funding position of the plan is preprogrammed to fail. Surely, the use of shorter funding periods represents one method of resolving this problem.

In Figures 19 and 20, we illustrate the effect of a fifteen-year rather than a thirty-year funding period. As can be seen from the figures, the funding position improves very significantly. Both the funded ratio and the advance funding ratio converge much faster. Most important, by halving the funding period we add approximately 18 percentage points to the ultimate funded ratio and 20 percentage points to the ultimate advance funding ratio.

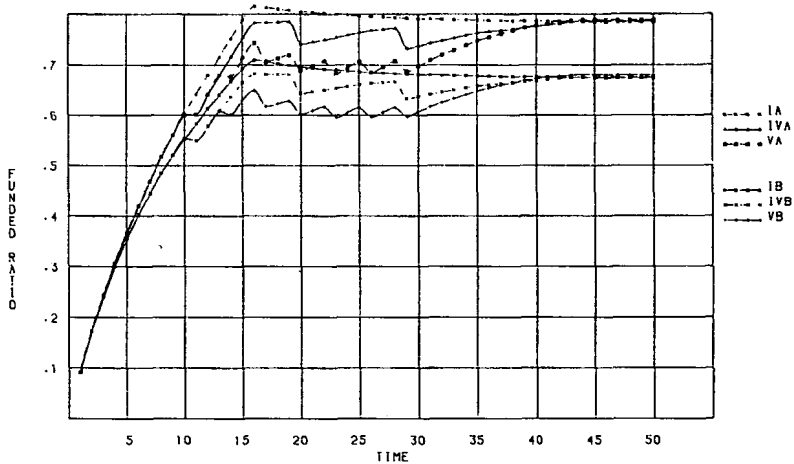


FIG. 19.—Funded ratios: constant work force; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios; fifteen-year amortization.

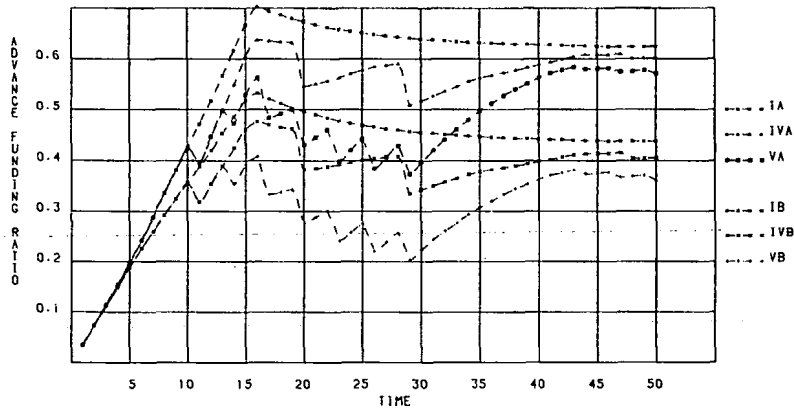


FIG. 20.—Advance funding ratio: constant work force; two scenarios on interest rate, pay, and benefit increase relationships; three retirement age scenarios; fifteen-year amortization.

The important question here is not whether fifteen years is a more appropriate period than, say, twenty years. What is germane as far as this discussion is concerned is that thirty years is too long, and plan sponsors who are concerned about their long-term funding position should consider shortening the funding period to improve the plan's position.

CONCLUSION

The foregoing analysis has illustrated several things about the erratic funding patterns of negotiated plans.

By tying negotiated increases in retiree benefit levels to the increases in active benefit levels in a systematic way, a significant upward bias is introduced into long-term costs. Moreover, when the increases in active benefit levels match or exceed both pay increases and the valuation interest rate, the resulting upward bias also tends to downplay the importance for costs of exhausting past-service liabilities. Over the years since the first plans were negotiated in the 1950s, bargainers have made little progress in holding down the rate of increase in benefits; this fact has contributed to the escalating contribution rates in today's plans.

The introduction of liberal early retirement benefits in the mid-1960s, and the corresponding rapid decline in the average retirement age that has followed in the wake of these liberalizations, have introduced very important long-term consequences for the contribution rates of the plans. The dramatic upward bias that such plan provisions impart to the contribution rate seems to be a permanent fixture of the contribution pattern for many plans.

Moreover, an economic event that brings with it a downturn in a firm's work force brings with it a corresponding upturn in contribution rates. These factors, coupled with a declining average retirement age, produce a very steeply increasing contribution rate.

Our analysis has demonstrated that the traditional practice of following thirty-year funding for past-service liabilities is preprogrammed to result in a poor funding position. If benefit increases keep up with pay increases and if both match the long-term valuation interest rate—a hypothesis that is not unrealistic given the history of negotiated plans—the long-term effect is a funded ratio of 45 percent and an advance funding ratio of zero. Both these measures of plan-funding progress would improve very significantly if the funding period were halved.

But can the foregoing rather idealized analysis present us with any useful information about real-world situations? I think so. Pension actuaries who are responsible for negotiated plans with heavily subsidized early retirement have only to look around them to know that something is amiss. It is not a mere coincidence that the pension landscape is littered with plans in

pathological condition. As the analysis of the very simple model described in this paper has shown, poor funding and increasing contribution rates are the rule rather than the exception in such plans.

If anything, our model ignores very significant plan provisions that increase plan costs. Most major industrial negotiated plans include very liberal surviving spouse and disability benefits. Such benefits increase the number of retirees in relation to the number of actives and also put further upward pressure on contribution levels and downward pressure on funded ratios. Also, our model ignores pre-social security supplemental allowances. As some firms recently have found out, when these supplemental allowances are funded in advance, very significant upward pressure on contribution rates often results. On the other hand, by assuming a constant valuation interest rate, the model also ignores the very significant capital appreciation in asset values that occurred before the end of the Vietnam War. When all things are considered, however, I think the model understates the true extent of the problem facing these plans.

In spite of the massive amounts of time, energy, and money that have been spent over the years since the first plans were negotiated in the 1950s, neither side of the bargaining table has produced much to be proud of in the 1980s. Can management bargainers seriously be happy with a negotiating strategy that has resulted in benefit levels that have increased faster than pay? That has resulted in contribution rates that are on an upward spiral? That has resulted in plans so poorly funded that, after thirty years, the liabilities attached to retirees are not yet funded?

And what about the union bargainers? What pride can be attached to a plan that produces costs so extraordinary that it literally puts companies out of business and forces their members from their jobs? What good is a plan to a participant who makes a basic and irreversible life decision to retire at a very early age only to find—a few years after retirement—that the firm he retired from has gone out of business and the pension he has learned to count on is suddenly and permanently reduced as the Pension Benefit Guaranty Corporation (PBGC) steps in?

This is not to say that the parties to the negotiations have deliberately conspired to produce poorly funded pension plans. On the contrary, the parties have made a good-faith effort to provide for the orderly funding of their plans. Very early in the bargaining history, the funding of negotiated plans became an integral part of the pension package. The concept of thirty-year funding of unfunded actuarial liabilities, common to many industrial union plans, was spawned as a good-faith effort to provide orderly financing of the plans. The problem is that thirty-year funding of negotiated-plan unfunded actuarial liabilities is a flawed principle.

Back in the days when the average retirement age was at least 65, and when no benefit increases were granted to retirees, thirty-year funding was an acceptable and adequate actuarial principle. However, as soon as the bargainers began granting benefit increases to active employees that increased faster than pay, began consistently granting increases to retirees that were tied to the active-employee benefit levels, and began introducing liberalized early retirement benefits that significantly reduced the average retirement age, the adequacy of thirty-year funding was eroded. In some cases, without either side of the bargaining table realizing it, a "free lunch" had been spawned: very significant plan improvements could be negotiated and, if the resulting unfunded actuarial liabilities were spread over thirty years, the cost could be held within reasonable bounds.

But, as every businessman knows, there can be no "free lunch." It does not take an actuary to know that by spreading the cost of a benefit increase for a retiree with a ten-year life expectancy over thirty years, we are simply "borrowing from Peter to pay Paul." The result has been that the assets of many negotiated plans have become prematurely depleted. Therefore, the component of pension expense associated with the amortization of unfunded actuarial liabilities is the predominant feature.

It is not unusual to find negotiated pension plans today whose pension expense is 10 percent normal cost and 90 percent amortization payments. This situation is acceptable for both sides of the bargaining table as long as the economic climate is rosy and employment levels are up. But as soon as the economy sours in a significant way, as it has, for example, within the automobile industry in the period 1979-81, the picture changes significantly. Suddenly, the fixed amortization payments, spread over a shrinking active-employee work force, can become a crushing burden.

It is ironic that, had the bargainers adopted a funding principle that recognized the inherent instability of negotiated-plan funding back in the 1950s, not only is it unlikely that we would have the funding problems we have today but it is also unlikely that management would have agreed to the benefit liberalizations in the first place. It is equally ironic that the agency of government that has been entrusted with the responsibility of enforcing minimum funding requirements has over the years promulgated rules that have contributed to the poorly funded positions of many negotiated plans. The Internal Revenue Service's absurd proscription against recognizing improvements to negotiated plans that occur after the end of the bargaining agreement has allowed both sides of the bargaining table a degree of flexibility that they would not have had if they had negotiated pension plans with benefits dependent upon final pay, instead of benefits that are expressed as a flat unit per year of service. The time has come for employers to set

aside the past and look to new innovative ways to bolster the funded position of their negotiated plans.

Firms will have to make the funding of plans an issue at bargaining. The long-term funding implications of the plans they have bargained will have to become an issue the union must face up to at the bargaining table. Given the 30 percent of net worth PBGC liability at plan termination, firms and their creditors cannot live with funded ratios of 40 and 50 percent. It is a rare plan that can cover its PBGC liabilities, much less its vested liabilities, with a 45 percent "entry age normal cost" funded ratio. It is my opinion that, if the probability of plan termination is at all significant, a plan is only as good as its funding. On this basis, I believe that the funding of many negotiated plans will have to be deliberately accelerated if sufficient funds are to be on hand when the participants and the firm and its creditors need them the most—at plan termination time.

At one time, employers could count on the union's interest in the funding of plans. In fact, in the early days, a major union went on strike over the issue of funding. But those were the days when, at plan termination time, the assets of the plan were generally all that was available to provide for plan benefits.

Today we have plan termination insurance. In spite of the fact that the PBGC does not guarantee all benefits, this insurance relieves many of the unions' worries about funding. This is not to say that unions have no interest in funding. After all, a funding cushion is advantageous from the union point of view in cases where the firm is in financial difficulty and needs some form of relief. Further, a better funding position in plans with nonguaranteeable early retirement supplements seems to be desirable from the union point of view given the PBGC's method of allocating assets upon plan termination. But, by and large, it is my opinion that firms that are interested in bettering their long-term funding position by charging it to the package are in for a tough set of negotiations.

In my opinion, the solution to the very fundamental problems facing many negotiated pension plans will not be found in the old methods of bargaining. Both sides of the bargaining table have to come to the realization that, above all ideological differences, the firm's continued existence as a competitive force in the marketplace is of primary importance. No significant progress can be hoped for in this area until the old adversarial relationship is broken down and both sides meet on their common ground—the firm's good health. The pension actuary, with his unique perspective on the problem, can play a key role in a new bargaining atmosphere if he can set aside his particular allegiances and assume his true role as a guardian of the plan participant.

APPENDIX

In the following tables will be found the numerical backup for each of the simulations of Table 1. In each case the amortization period is assumed to be thirty years. Also, $P_0 = B_0 = 1$.

The column headings have the following meanings:

T	Time
RET AGE	Retirement age assumption in the valuation at time T
ACTIVE	Number of active participants at time T
RETIRED	Number of retired participants at time T
ACT-RET	Ratio of active participants to retired participants at time T
PENSIONS	Annual pensions in pay status at time T
NORMAL COST	At $T = 1$, the entry age normal cost; for $T > 1$, the normal cost determined by the frozen initial liability method
PAST SVC COST	At time T , the sum of at most thirty separate amortization amounts
TOTAL COST	Sum of normal cost plus past-service cost at time T
% OF PAY	Total cost as a percentage of payroll at time T divided by the total cost as a percentage of payroll at time 1
UNFUNDED PAST SVC	Frozen initial liability accumulated with interest to time T , increased by liabilities associated with benefit increases or reductions in retirement age, and decreased by the accumulation of past-service cost payments to time T
FUNDS	Total cost less pensions, accumulated at 5 percent at time T
FNDED RATIO	Ratio of funds to the sum of funds plus the unfunded past-service liability at time T
PAY	Assumed total annual payroll of active participants at time T
PVFB ACTIVES	Present value of future benefits for active participants at time T
PVFB RETIRED	Present value of future benefits for retired participants at time T
PVF SERVICE	Present value of future working lifetime of active participants at time T

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD $F = 0.80$

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL	PAST SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDSD	PAY	PVFB	PVFB	PVF
AGE					COST	COST	COST	COST	PAY	PAST SVC		RATIO		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.	45893.	0.251	67355.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.	54924.	0.284	69376.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.	63927.	0.313	71457.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.	72915.	0.340	73601.	174551.	60022.	592170.
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	1.0030	143357.	81870.	0.363	75809.	179781.	67154.	592170.
10	65	59845.	7171.	8.3	8484.	2761.	10549.	13309.	1.0075	144266.	90789.	0.383	78003.	185181.	74369.	592170.
11	65	59845.	7726.	7.7	9426.	2844.	10935.	13779.	1.0127	1448750.	99682.	0.401	80425.	190736.	81481.	592170.
12	65	59845.	8247.	7.3	10375.	2929.	11343.	14272.	1.0184	1451291.	108564.	0.418	82838.	196458.	88483.	592170.
13	65	59845.	8732.	6.9	11329.	3017.	11773.	14790.	1.0246	1453872.	117452.	0.433	85323.	202351.	95366.	592170.
14	65	59845.	9181.	6.5	12285.	3108.	12223.	15330.	1.0311	1456473.	126371.	0.447	87883.	208422.	102125.	592170.
15	65	59845.	9593.	6.2	13239.	3201.	12694.	15895.	1.0380	1459074.	135345.	0.460	90519.	214674.	108761.	592170.
16	65	59845.	9967.	6.0	14190.	3297.	13187.	16484.	1.0451	1461655.	144406.	0.472	93235.	221114.	115275.	592170.
17	65	59845.	10304.	5.8	15134.	3396.	13702.	17097.	1.0524	1464192.	153589.	0.483	96032.	227747.	121672.	592170.
18	65	59845.	10604.	5.6	16070.	3498.	14238.	17735.	1.0599	1466664.	162933.	0.494	98913.	234580.	127962.	592170.
19	65	59845.	10869.	5.5	16996.	3603.	14795.	18398.	1.0674	1469047.	172481.	0.505	101880.	241617.	134158.	592170.
20	65	59845.	11100.	5.4	17912.	3711.	15375.	19085.	1.0751	1471317.	182278.	0.515	104936.	248865.	140274.	592170.
21	65	59845.	11299.	5.3	18818.	3822.	15976.	19798.	1.0827	1473448.	192372.	0.526	108084.	256331.	146328.	592170.
22	65	59845.	11470.	5.2	19713.	3937.	16600.	20537.	1.0904	1475416.	202814.	0.536	111327.	264021.	152340.	592170.
23	65	59845.	11616.	5.2	20605.	4055.	17246.	21301.	1.0981	1477193.	213650.	0.547	114666.	271941.	158328.	592170.
24	65	59845.	11736.	5.1	21486.	4176.	17916.	22092.	1.1057	1478750.	224939.	0.557	118106.	280099.	164310.	592170.
25	65	59845.	11834.	5.1	22362.	4302.	18609.	22911.	1.1133	180061.	236734.	0.568	121649.	288502.	170311.	592170.
26	65	59845.	11914.	5.0	23236.	4431.	19326.	23757.	1.1207	181095.	249091.	0.579	125299.	297157.	176352.	592170.
27	65	59845.	11977.	5.0	24111.	4564.	20067.	24631.	1.1281	181821.	262065.	0.590	129058.	306071.	182454.	592170.
28	65	59845.	12027.	5.0	24989.	4701.	20833.	25534.	1.1354	182207.	275713.	0.602	132929.	315253.	188636.	592170.
29	65	59845.	12066.	5.0	25873.	4842.	21625.	26466.	1.1426	182220.	290091.	0.614	136917.	324710.	194918.	592170.
30	65	59845.	12096.	4.9	26767.	4987.	22442.	27429.	1.1497	181824.	305258.	0.627	141024.	334452.	201316.	592170.
31	65	59845.	12118.	4.9	27672.	5137.	23279.	28415.	0.8308	180981.	313264.	0.634	145255.	344484.	207846.	592170.
32	65	59845.	12134.	4.9	28593.	5291.	24111.	29401.	0.8376	188063.	321536.	0.631	149612.	354819.	214524.	592170.
33	65	59845.	12146.	4.9	29530.	5450.	25033.	30383.	0.8444	195291.	330095.	0.628	154101.	365463.	221364.	592170.
34	65	59845.	12154.	4.9	30488.	5613.	25988.	31361.	0.8510	202664.	338962.	0.626	158724.	376427.	228378.	592170.
35	65	59845.	12159.	4.9	31467.	5781.	26974.	32346.	0.8575	210179.	348158.	0.624	163485.	387719.	235578.	592170.
36	65	59845.	12163.	4.9	32471.	5955.	28009.	33337.	0.8639	217833.	357704.	0.622	168389.	399350.	242974.	592170.
37	65	59845.	12165.	4.9	33501.	6134.	29097.	34334.	0.8701	225625.	367619.	0.620	173441.	411330.	250577.	592170.
38	65	59845.	12167.	4.9	34558.	6318.	30163.	35337.	0.8762	233552.	377923.	0.618	178644.	423670.	258395.	592170.
39	65	59845.	12167.	4.9	35644.	6507.	30918.	36345.	0.8810	241609.	388599.	0.617	184003.	436380.	266438.	592170.
40	65	59845.	12168.	4.9	36761.	6703.	31674.	37367.	0.8850	249833.	399644.	0.615	189523.	449471.	274713.	592170.
41	65	59845.	12168.	4.9	37910.	6904.	32444.	38408.	0.8887	258246.	411063.	0.614	195209.	462954.	283230.	592170.
42	65	59845.	12168.	4.9	39093.	7111.	33230.	39341.	0.8920	266861.	422863.	0.613	201065.	476433.	291996.	592170.
43	65	59845.	12168.	4.9	40310.	7324.	34032.	40271.	0.8950	275688.	435053.	0.612	207097.	491148.	301020.	592170.
44	65	59845.	12168.	4.9	41562.	7544.	34852.	41209.	0.8977	284737.	447639.	0.611	213309.	505881.	310309.	592170.
45	65	59845.	12168.	4.9	42851.	7770.	35690.	42157.	0.9002	294022.	460629.	0.610	219708.	521057.	318873.	592170.
46	65	59845.	12168.	4.9	44178.	8003.	36548.	43111.	0.9025	303554.	474033.	0.610	226300.	536689.	327920.	592170.
47	65	59845.	12168.	4.9	45504.	8244.	37411.	44071.	0.9042	313094.	487886.	0.609	233088.	552789.	336611.	592170.
48	65	59845.	12168.	4.9	46869.	8491.	38295.	45041.	0.9057	322872.	502197.	0.609	240081.	569372.	346799.	592170.
49	65	59845.	12168.	4.9	48275.	8746.	39199.	46074.	0.9070	332899.	516976.	0.608	247283.	586453.	356292.	592170.
50	65	59845.	12168.	4.9	49723.	9008.	30125.	39133.	0.9082	343186.	532234.	0.608	254701.	604046.	371101.	592170.

SIMULATION IB

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDSD	PAY	PVFB	PVFB	PVF
AGE						COST	COST	COST	COST	PAY	PAST SVC		FNDED		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129280.	9297.	0.067	59845.	141927.	8271.	592170.	
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.	
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.	592170.	
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.	
5	65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40916.	592170.	
6	65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57851.	0.273	76378.	181137.	49567.	592170.	
7	65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160275.	68001.	0.298	80197.	190194.	58884.	592170.	
8	65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.	592170.	
9	65	59845.	6582.	9.1	8809.	3126.	12197.	15324.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.	592170.	
10	65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.	592170.	
11	65	59845.	7726.	7.7	11424.	3447.	13759.	17206.	1.0433	191574.	110043.	0.365	97480.	231181.	98759.	592170.	
12	65	59845.	8247.	7.3	12819.	3619.	14627.	18246.	1.0537	200711.	120972.	0.376	102353.	242740.	109328.	592170.	
13	65	59845.	8732.	6.9	14269.	3800.	15555.	19355.	1.0646	210374.	132106.	0.386	107471.	254877.	120120.	592170.	
14	65	59845.	9181.	6.5	15774.	3990.	16547.	20537.	1.0758	220559.	143474.	0.394	112844.	267620.	131132.	592170.	
15	65	59845.	9593.	6.2	17330.	4190.	17603.	21792.	1.0872	231261.	155110.	0.401	118487.	281001.	142364.	592170.	
16	65	59845.	9967.	6.0	18935.	4399.	18726.	23125.	1.0987	242476.	167056.	0.408	124411.	295051.	153820.	592170.	
17	65	59845.	10304.	5.8	20587.	4619.	19920.	24539.	1.0144	254198.	179360.	0.414	130631.	309803.	165509.	592170.	
18	65	59845.	10604.	5.6	22285.	4850.	21185.	26035.	1.1220	266420.	192078.	0.419	137163.	325293.	177466.	592170.	
19	65	59845.	10869.	5.5	24027.	5092.	22526.	27618.	1.1335	279135.	205273.	0.424	144021.	341557.	189650.	592170.	
20	65	59845.	11100.	5.4	25813.	5347.	23944.	29291.	1.1450	292334.	219015.	0.428	151221.	358635.	202146.	592170.	
21	65	59845.	11299.	5.3	27644.	5614.	25443.	31058.	1.1562	306010.	233379.	0.433	158782.	376566.	214965.	592170.	
22	65	59845.	11470.	5.2	29522.	5895.	27027.	32922.	1.1672	320154.	248448.	0.437	166721.	395394.	228142.	592170.	
23	65	59845.	11616.	5.2	31458.	6190.	28698.	34888.	1.1780	334757.	264301.	0.441	175057.	415163.	241714.	592170.	
24	65	59845.	11736.	5.1	33439.	6499.	30461.	36960.	1.1886	349809.	281037.	0.445	183810.	435921.	255717.	592170.	
25	65	59845.	11834.	5.1	35479.	6824.	32318.	39143.	1.1988	365303.	298753.	0.450	193000.	457716.	270204.	592170.	
26	65	59845.	11914.	5.0	37581.	7166.	34276.	41441.	1.2088	381227.	317550.	0.454	202650.	480662.	285221.	592170.	
27	65	59845.	11977.	5.0	39753.	7524.	36337.	43861.	1.2185	397573.	337536.	0.459	212782.	504631.	300820.	592170.	
28	65	59845.	12027.	5.0	42000.	7900.	38508.	46408.	1.2278	414327.	358820.	0.464	223421.	529862.	317051.	592170.	
29	65	59845.	12066.	5.0	44331.	8295.	40792.	49087.	1.2369	431482.	381517.	0.469	234592.	556355.	333970.	592170.	
30	65	59845.	12096.	4.9	46752.	8710.	43496.	51906.	1.2456	449023.	405746.	0.475	246321.	584172.	351629.	592170.	
31	65	59845.	12118.	4.9	49273.	9145.	46376.	54862.	1.2546	466937.	429622.	0.476	258637.	613380.	370085.	592170.	
32	65	59845.	12134.	4.9	51900.	9603.	49776.	57979.	1.2639	485619.	454281.	0.473	271569.	644048.	389393.	592170.	
33	65	59845.	12146.	4.9	54643.	10083.	52353.	61246.	1.2730	505184.	482398.	0.470	285147.	676250.	409611.	592170.	
34	65	59845.	12154.	4.9	57510.	10587.	55441.	64854.	1.2824	526495.	512184.	0.468	299404.	710062.	430795.	592170.	
35	65	59845.	12159.	4.9	60510.	11116.	59485.	68601.	1.2919	549949.	540712.	0.465	314374.	745565.	453005.	592170.	
36	65	59845.	12163.	4.9	63653.	11672.	64186.	73186.	1.3012	575265.	572931.	0.463	330092.	782842.	476300.	592170.	
37	65	59845.	12165.	4.9	66946.	12256.	69309.	78525.	1.3106	603788.	607769.	0.459	346596.	821983.	500741.	592170.	
38	65	59845.	12167.	4.9	70400.	12869.	74900.	84587.	1.3194	634393.	646578.	0.456	363926.	863082.	526391.	592170.	
39	65	59845.	12167.	4.9	74023.	13512.	80700.	90753.	1.3278	666135.	693111.	0.457	382122.	906235.	553314.	592170.	
40	65	59845.	12168.	4.9	77825.	14188.	87291.	97479.	1.3357	700055.	745475.	0.458	401227.	951545.	581577.	592170.	
41	65	59845.	12168.	4.9	81816.	14897.	94658.	104855.	1.3433	739411.	795311.	0.457	421288.	999122.	611250.	592170.	
42	65	59845.	12168.	4.9	86006.	15642.	102480.	112482.	1.3505	783931.	849575.	0.456	442352.	1049077.	642405.	592170.	
43	65	59845.	12168.	4.9	90405.	16424.	109900.	121084.	1.3573	834927.	909727.	0.455	464669.	1101529.	675116.	592170.	
44	65	59845.	12168.	4.9	95024.	17246.	117424.	130699.	1.3637	893699.	975311.	0.454	487624.	1156604.	709464.	592170.	
45	65	59845.	12168.	4.9	99873.	18108.	125076.	139872.	1.3697	957276.	1046506.	0.453	512076.	1214433.	745530.	592170.	
46	65	59845.	12168.	4.9	104966.	19013.	133496.	149410.	1.3753	1023586.	1121817.	0.452	537680.	1275154.	783402.	592170.	
47	65	59845.	12168.	4.9	110214.	19964.	143994.	159558.	1.3805	1097568.	1203312.	0.452	564563.	1338911.	822571.	592170.	
48	65	59845.	12168.	4.9	115725.	20962.	155800.	170958.	1.3853	1180453.	1297913.	0.452	592791.	1405854.	863699.	592170.	
49	65	59845.	12168.	4.9	121511.	22010.	168223.	183823.	1.3897	1273475.	1397775.	0.451	622429.	1476145.	906883.	592170.	
50	65	59845.	12168.	4.9	127586.	23111.	182387.	198988.	1.3938	1377872.	1503211.	0.451	653550.	1549951.	952226.	592170.	

SIMULATION IIA

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T AGE	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS	FNOED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	0.9810	131192.	18531.	0.124	62837.	146104.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	0.9623	133084.	27705.	0.172	65979.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	0.9439	134932.	36823.	0.214	69277.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	0.9260	136727.	45893.	0.251	72741.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	0.9083	138644.	54924.	0.284	76378.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	0.8910	140134.	63927.	0.313	80197.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	0.8741	141738.	72915.	0.340	84207.	174551.	60062.	592170.
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	0.8599	143577.	81870.	0.363	88417.	179787.	67154.	592170.
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	0.8474	146266.	90789.	0.383	92838.	185181.	74369.	592170.
11	65	59845.	7726.	7.7	9426.	2844.	10935.	13779.	0.8356	148750.	99862.	0.401	97480.	190736.	81481.	592170.
12	65	59845.	8247.	7.3	10375.	2929.	11343.	14272.	0.8243	151291.	108544.	0.418	102353.	196458.	88483.	592170.
13	65	59845.	8732.	6.9	11329.	3017.	11773.	14790.	0.8134	153872.	117452.	0.433	107471.	202351.	95366.	592170.
14	65	59845.	9191.	6.5	12285.	3108.	12223.	15330.	0.8030	156473.	126371.	0.447	112844.	208422.	102125.	592170.
15	65	59845.	9593.	6.2	13239.	3201.	12694.	15895.	0.7930	159074.	135345.	0.460	118487.	214674.	108761.	592170.
16	65	59845.	9967.	6.0	14190.	3297.	13187.	16484.	0.7832	161655.	144406.	0.472	124411.	221114.	115275.	592170.
17	65	59845.	10304.	5.8	15134.	3396.	13702.	17097.	0.7737	164192.	153589.	0.483	130631.	227747.	121672.	592170.
18	65	59845.	10604.	5.6	16070.	3498.	14238.	17735.	0.7643	166664.	162933.	0.494	137163.	234580.	127962.	592170.
19	65	59845.	10869.	5.5	16996.	3603.	14795.	18398.	0.7551	169047.	172481.	0.505	144021.	241617.	134158.	592170.
20	65	59845.	11100.	5.4	17912.	3711.	15375.	19085.	0.7460	171317.	181517.	0.515	151221.	248865.	140274.	592170.
21	65	59845.	11299.	5.3	18818.	3822.	15976.	19798.	0.7370	173448.	192372.	0.526	158782.	256331.	146328.	592170.
22	65	59845.	11470.	5.2	19713.	3937.	16600.	20537.	0.7281	175416.	202814.	0.536	166721.	264021.	152340.	592170.
23	65	59845.	11616.	5.2	20605.	4055.	17246.	21301.	0.7193	177193.	213650.	0.547	175057.	271941.	158328.	592170.
24	65	59845.	11736.	5.1	21486.	4176.	17916.	22092.	0.7105	178755.	224939.	0.557	183810.	280099.	164310.	592170.
25	65	59845.	11834.	5.1	22362.	4302.	18609.	22911.	0.7017	180061.	236734.	0.568	193000.	288502.	170311.	592170.
26	65	59845.	11914.	5.0	23236.	4431.	19326.	23757.	0.6930	181095.	249091.	0.579	202650.	297157.	176352.	592170.
27	65	59845.	11977.	5.0	24111.	4564.	20067.	24631.	0.6842	181821.	262065.	0.590	212782.	306071.	182454.	592170.
28	65	59845.	12027.	5.0	24989.	4701.	20833.	25534.	0.6755	182207.	275713.	0.602	223421.	315253.	188636.	592170.
29	65	59845.	12066.	5.0	25873.	4842.	21625.	26466.	0.6669	182220.	290091.	0.614	234592.	324710.	194918.	592170.
30	65	59845.	12096.	4.9	26767.	4987.	22442.	27429.	0.6582	181824.	305258.	0.627	246321.	334452.	201316.	592170.
31	65	59845.	12118.	4.9	27672.	5137.	23279.	28415.	0.6496	180981.	313264.	0.634	258637.	344484.	207866.	592170.
32	65	59845.	12134.	4.9	28593.	5291.	24121.	29419.	0.6415	180061.	321536.	0.631	271569.	354819.	214524.	592170.
33	65	59845.	12146.	4.9	29530.	5450.	25030.	30433.	0.6336	179193.	330095.	0.628	285147.	365463.	221364.	592170.
34	65	59845.	12154.	4.9	30480.	5613.	26033.	31463.	0.6259	178348.	338962.	0.626	299404.	376427.	228378.	592170.
35	65	59845.	12159.	4.9	31447.	5781.	27094.	32516.	0.6185	177529.	348158.	0.624	314374.	387719.	235578.	592170.
36	65	59845.	12163.	4.9	32431.	5955.	28164.	33649.	0.6112	176733.	357704.	0.622	330092.	399350.	242974.	592170.
37	65	59845.	12165.	4.9	33501.	6134.	29317.	34809.	0.6043	175952.	367619.	0.620	346596.	411330.	250577.	592170.
38	65	59845.	12167.	4.9	34558.	6318.	30463.	36041.	0.5974	175183.	377923.	0.618	363926.	423670.	258955.	592170.
39	65	59845.	12167.	4.9	35644.	6507.	31694.	37285.	0.5907	174429.	388599.	0.617	382122.	436380.	266438.	592170.
40	65	59845.	12168.	4.9	36761.	6703.	32974.	38576.	0.5841	173683.	399644.	0.615	401227.	449471.	274713.	592170.
41	65	59845.	12168.	4.9	37910.	6904.	34310.	39919.	0.5776	172944.	411063.	0.614	421288.	462954.	283230.	592170.
42	65	59845.	12168.	4.9	39093.	7111.	35700.	41311.	0.5712	172212.	422863.	0.613	442352.	476843.	291996.	592170.
43	65	59845.	12168.	4.9	40310.	7324.	37124.	42663.	0.5649	171487.	435053.	0.612	464469.	491148.	301020.	592170.
44	65	59845.	12168.	4.9	41562.	7544.	38582.	44075.	0.5588	170769.	447639.	0.611	487692.	505881.	310309.	592170.
45	65	59845.	12168.	4.9	42851.	7770.	39990.	45629.	0.5529	170062.	460629.	0.610	512076.	521057.	319873.	592170.
46	65	59845.	12168.	4.9	44178.	8003.	41548.	47233.	0.5471	169364.	474033.	0.610	537680.	536689.	329720.	592170.
47	65	59845.	12168.	4.9	45504.	8244.	43101.	48886.	0.5414	168673.	487886.	0.609	564563.	552789.	339611.	592170.
48	65	59845.	12168.	4.9	46869.	8491.	44700.	50322.	0.5358	168000.	502197.	0.609	592791.	569372.	349799.	592170.
49	65	59845.	12168.	4.9	48275.	8746.	46259.	51999.	0.5303	167343.	516976.	0.608	622429.	586453.	360292.	592170.
50	65	59845.	12168.	4.9	49723.	9008.	47855.	53733.	0.5253	166693.	532234.	0.608	653950.	604046.	371101.	592170.

SIMULATION IIB

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.0

440

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDSD	PAY	PVFB	PVFB	PVFB	PVF
AGE						COST	COST	COST	COST	PAY	PAST SVC		RATIO		ACTIVES	RETIRED	SERVICE	
1	65	59845.	827.	72.4	827.	211.6	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.		
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	0.9810	131192.	18531.	0.124	62837.	146184.	16336.	592170.		
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	0.9623	133084.	27705.	0.172	65979.	150570.	24185.	592170.		
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	0.9439	134932.	36823.	0.214	69277.	155087.	31815.	592170.		
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	0.9260	136727.	45893.	0.251	72741.	159739.	39218.	592170.		
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	0.9083	138464.	54924.	0.284	76378.	164531.	46394.	592170.		
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	0.8910	140134.	63927.	0.313	80197.	169467.	53339.	592170.		
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12451.	0.8741	141731.	72915.	0.340	84207.	174551.	60054.	592170.		
9	65	59845.	6582.	9.1	7481.	2681.	10144.	12825.	0.8574	143244.	81905.	0.364	88477.	179787.	66542.	592170.		
10	65	59845.	7171.	8.3	8294.	2761.	10449.	13210.	0.8411	144667.	90915.	0.386	92838.	185181.	72806.	592170.		
11	65	59845.	7726.	7.7	9099.	2844.	10762.	13606.	0.8251	145988.	99968.	0.406	97480.	190736.	78853.	592170.		
12	65	59845.	8247.	7.3	9892.	2929.	11085.	14014.	0.8093	147198.	109088.	0.426	102353.	196458.	84691.	592170.		
13	65	59845.	8732.	6.9	10674.	3017.	11418.	14355.	0.7939	148286.	118303.	0.444	107471.	202351.	90331.	592170.		
14	65	59845.	9181.	6.5	11443.	3108.	11760.	14688.	0.7788	149264.	127642.	0.461	112844.	208422.	95786.	592170.		
15	65	59845.	9593.	6.2	12198.	3201.	12113.	15014.	0.7644	150048.	137139.	0.478	118487.	214674.	101070.	592170.		
16	65	59845.	9967.	6.0	12938.	3297.	12476.	15314.	0.7494	150697.	146831.	0.494	124411.	221114.	106201.	592170.		
17	65	59845.	10304.	5.8	13663.	3396.	12850.	15673.	0.7351	151173.	156755.	0.509	130631.	227747.	111199.	592170.		
18	65	59845.	10604.	5.6	14373.	3498.	13236.	16014.	0.7211	151461.	166953.	0.524	137163.	234580.	116083.	592170.		
19	65	59845.	10869.	5.5	15070.	3603.	13633.	16333.	0.7074	151545.	177467.	0.539	144021.	241617.	120876.	592170.		
20	65	59845.	11100.	5.4	15753.	3711.	14042.	16633.	0.6939	151408.	188340.	0.554	151221.	248865.	125600.	592170.		
21	65	59845.	11299.	5.3	16425.	3822.	14463.	16913.	0.6807	151033.	199617.	0.569	158782.	256331.	130278.	592170.		
22	65	59845.	11470.	5.2	17084.	3937.	14897.	17173.	0.6677	150402.	211344.	0.584	166771.	264021.	134932.	592170.		
23	65	59845.	11616.	5.2	17747.	4055.	15344.	17413.	0.6550	149493.	223563.	0.599	175057.	271941.	139585.	592170.		
24	65	59845.	11736.	5.1	18399.	4176.	15804.	17683.	0.6425	148285.	236323.	0.614	183810.	280099.	144253.	592170.		
25	65	59845.	11834.	5.1	19049.	4302.	16278.	17933.	0.6303	146757.	249670.	0.630	193000.	288502.	148960.	592170.		
26	65	59845.	11914.	5.0	19700.	4431.	16767.	18183.	0.6183	144885.	263651.	0.645	202650.	297157.	153725.	592170.		
27	65	59845.	11977.	5.0	20355.	4564.	17270.	18433.	0.6065	142642.	278312.	0.661	212782.	306071.	158563.	592170.		
28	65	59845.	12027.	5.0	21015.	4701.	17788.	18683.	0.5950	140002.	293700.	0.677	223421.	315253.	163491.	592170.		
29	65	59845.	12066.	5.0	21685.	4842.	18321.	18933.	0.5836	136938.	309863.	0.694	234592.	324710.	168522.	592170.		
30	65	59845.	12096.	4.9	22365.	4987.	18871.	19183.	0.5725	133419.	326449.	0.710	246321.	334452.	173670.	592170.		
31	65	59845.	12118.	4.9	23058.	5137.	19429.	19433.	0.5615	129412.	336698.	0.722	258637.	344484.	178946.	592170.		
32	65	59845.	12134.	4.9	23766.	5291.	19977.	19683.	0.5504	132923.	346830.	0.722	271569.	354819.	184361.	592170.		
33	65	59845.	12146.	4.9	24490.	5450.	20525.	19933.	0.5393	137291.	357255.	0.722	285147.	365463.	189923.	592170.		
34	65	59845.	12154.	4.9	25233.	5613.	21088.	18101.	0.5284	141409.	367985.	0.722	299404.	376427.	195642.	592170.		
35	65	59845.	12159.	4.9	25995.	5781.	21664.	18351.	0.5175	145650.	379033.	0.722	314374.	387719.	201524.	592170.		
36	65	59845.	12163.	4.9	26781.	5955.	22250.	18601.	0.5069	150036.	390408.	0.722	330092.	399350.	207596.	592170.		
37	65	59845.	12165.	4.9	27596.	6134.	22846.	18851.	0.4967	154627.	402119.	0.722	346596.	411330.	213918.	592170.		
38	65	59845.	12167.	4.9	28448.	6318.	23442.	19101.	0.4868	159471.	414169.	0.722	363926.	423670.	220539.	592170.		
39	65	59845.	12167.	4.9	29341.	6507.	24049.	19351.	0.4771	164602.	426563.	0.722	382122.	436380.	227490.	592170.		
40	65	59845.	12168.	4.9	30280.	6703.	24677.	19601.	0.4677	170050.	439301.	0.721	401227.	449471.	234792.	592170.		
41	65	59845.	12168.	4.9	31266.	6904.	25326.	19851.	0.4584	175827.	452382.	0.720	421288.	462954.	242450.	592170.		
42	65	59845.	12168.	4.9	32302.	7111.	26087.	20101.	0.4491	181940.	465808.	0.719	442352.	476843.	250461.	592170.		
43	65	59845.	12168.	4.9	33387.	7324.	26843.	20351.	0.4400	188395.	479578.	0.718	464469.	491148.	258819.	592170.		
44	65	59845.	12168.	4.9	34521.	7544.	27613.	20601.	0.4311	195197.	493693.	0.717	487692.	505881.	267520.	592170.		
45	65	59845.	12168.	4.9	35705.	7770.	28403.	20851.	0.4224	202350.	508156.	0.715	512078.	521057.	276558.	592170.		
46	65	59845.	12168.	4.9	36936.	8003.	29213.	21101.	0.4139	209851.	522970.	0.714	537680.	536689.	285920.	592170.		
47	65	59845.	12168.	4.9	38273.	8244.	29943.	21351.	0.4056	216746.	538224.	0.713	564563.	552789.	294647.	592170.		
48	65	59845.	12168.	4.9	39721.	8491.	30693.	21601.	0.3974	223831.	553934.	0.712	592791.	569372.	303613.	592170.		
49	65	59845.	12168.	4.9	40441.	8746.	31463.	21851.	0.3892	231109.	570117.	0.712	622429.	586453.	312827.	592170.		

SIMULATION IIIA

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.0

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL COST	PAST COST	SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDED	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE	
1	65	59845.	827.	72.4	827.	2116.	8008.		10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.		10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.		10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.		11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.		11395.	1.0000	136727.	45893.	0.251	67355.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.		11737.	1.0000	138646.	54924.	0.284	69376.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.		12089.	1.0000	140134.	63927.	0.313	71457.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.		12451.	1.0000	141731.	72915.	0.340	73601.	174551.	60054.	592170.
9	65	59845.	6582.	9.1	7481.	2681.	10144.		12825.	1.0000	143244.	81905.	0.364	75809.	179787.	66542.	592170.
10	65	59845.	7171.	8.3	8294.	2761.	10449.		13210.	1.0000	144667.	90915.	0.388	78083.	185181.	72806.	592170.
11	65	59845.	7726.	7.7	9099.	2844.	10762.		13606.	1.0000	145988.	99968.	0.408	80425.	190736.	78853.	592170.
12	65	59845.	8247.	7.3	9892.	2929.	11085.		14014.	1.0000	147198.	109088.	0.426	82838.	196458.	84691.	592170.
13	65	59845.	8732.	6.9	10674.	3017.	11418.		14435.	1.0000	148286.	118303.	0.444	85323.	202351.	90331.	592170.
14	65	59845.	9181.	6.5	11443.	3108.	11760.		14866.	1.0000	149261.	127644.	0.461	87883.	208422.	95786.	592170.
15	65	59845.	9593.	6.2	12198.	3201.	12113.		15314.	1.0000	150048.	137139.	0.478	90519.	214674.	101070.	592170.
16	65	59845.	9967.	6.0	12938.	3297.	12476.		15773.	1.0000	150697.	146831.	0.494	93235.	221114.	106201.	592170.
17	65	59845.	10304.	5.8	13663.	3396.	12850.		16246.	1.0000	151173.	156755.	0.509	96032.	227747.	111199.	592170.
18	65	59845.	10604.	5.6	14373.	3498.	13236.		16734.	1.0000	151461.	166953.	0.524	98913.	234580.	116083.	592170.
19	65	59845.	10869.	5.5	15070.	3603.	13633.		17236.	1.0000	151545.	177467.	0.539	101880.	241617.	120876.	592170.
20	65	59845.	11100.	5.4	15753.	3711.	14042.		17753.	1.0000	151408.	188340.	0.554	104936.	248865.	125600.	592170.
21	65	59845.	11299.	5.3	16425.	3822.	14463.		18285.	1.0000	151033.	199617.	0.569	108084.	256331.	130278.	592170.
22	65	59845.	11470.	5.2	17088.	3937.	14897.		18834.	1.0000	150402.	211344.	0.584	111327.	264021.	134932.	592170.
23	65	59845.	11616.	5.2	17747.	4055.	15344.		19399.	1.0000	149493.	223563.	0.599	114666.	271941.	139585.	592170.
24	65	59845.	11736.	5.1	18399.	4176.	15804.		19981.	1.0000	148285.	236323.	0.614	118106.	280099.	144253.	592170.
25	65	59845.	11834.	5.1	19049.	4302.	16278.		20580.	1.0000	146757.	249670.	0.630	121649.	288502.	148960.	592170.
26	65	59845.	11914.	5.0	19700.	4431.	16787.		21197.	1.0000	144885.	263651.	0.645	125299.	297157.	153725.	592170.
27	65	59845.	11977.	5.0	20355.	4564.	17270.		21833.	1.0000	142642.	278312.	0.661	129058.	306071.	158663.	592170.
28	65	59845.	12027.	5.0	21015.	4701.	17788.		22488.	1.0000	140002.	293700.	0.677	132929.	315253.	163491.	592170.
29	65	59845.	12066.	5.0	21685.	4842.	18321.		23163.	1.0000	136938.	309863.	0.694	136917.	324710.	168522.	592170.
30	65	59845.	12096.	4.9	22365.	4987.	18871.		23858.	1.0000	133419.	326849.	0.710	141024.	334452.	173670.	592170.
31	65	59845.	12118.	4.9	23058.	5137.	19429.		24565.	0.6741	129412.	336698.	0.722	145255.	344484.	178946.	592170.
32	65	59845.	12134.	4.9	23766.	5291.	19997.		25295.	0.6741	133793.	348300.	0.722	149612.	354819.	184361.	592170.
33	65	59845.	12146.	4.9	24490.	5450.	20585.		26048.	0.6741	137291.	357255.	0.722	154101.	365463.	189223.	592170.
34	65	59845.	12154.	4.9	25233.	5613.	21258.		26824.	0.6741	141409.	367985.	0.722	158724.	376427.	195642.	592170.
35	65	59845.	12159.	4.9	25995.	5781.	21963.		27633.	0.6741	145650.	379033.	0.722	163485.	387719.	201524.	592170.
36	65	59845.	12163.	4.9	26781.	5955.	22700.		28475.	0.6742	150036.	390408.	0.722	168389.	399350.	207596.	592170.
37	65	59845.	12165.	4.9	27596.	6134.	23463.		29347.	0.6743	154627.	402119.	0.722	173441.	411330.	213918.	592170.
38	65	59845.	12167.	4.9	28448.	6318.	24205.		30293.	0.6748	159471.	414169.	0.722	178644.	423670.	220539.	592170.
39	65	59845.	12167.	4.9	29341.	6507.	25019.		31277.	0.6755	164602.	426563.	0.722	184003.	436380.	227490.	592170.
40	65	59845.	12168.	4.9	30280.	6703.	25877.		32300.	0.6765	170050.	439301.	0.721	189523.	449471.	234792.	592170.
41	65	59845.	12168.	4.9	31266.	6904.	26780.		33366.	0.6778	175827.	452382.	0.720	195209.	462954.	242450.	592170.
42	65	59845.	12168.	4.9	32302.	7111.	27728.		34493.	0.6794	181940.	465808.	0.719	201065.	476843.	250461.	592170.
43	65	59845.	12168.	4.9	33387.	7324.	28713.		35743.	0.6812	188395.	479578.	0.718	207097.	491148.	258819.	592170.
44	65	59845.	12168.	4.9	34521.	7544.	29744.		37164.	0.6833	195197.	493693.	0.717	213309.	505881.	267520.	592170.
45	65	59845.	12168.	4.9	35705.	7770.	30823.		38743.	0.6856	202350.	508156.	0.715	219708.	521057.	276558.	592170.
46	65	59845.	12168.	4.9	36936.	8003.	31950.		40463.	0.6881	209851.	522970.	0.714	226300.	536689.	285920.	592170.
47	65	59845.	12168.	4.9	38273.	8244.	33186.		42349.	0.6893	217466.	538224.	0.713	233088.	552789.	294647.	592170.
48	65	59845.	12168.	4.9	39711.	8491.	34543.		44300.	0.6904	225381.	553934.	0.712	240081.	569372.	303613.	592170.
49	65	59845.	12168.	4.9	40441.	8746.	36002.		28927.	0.6915	231109.	570117.	0.712	247283.	586453.	312827.	592170.
50	65	59845.	12168.	4.9	41673.	9008.	20833.		29841.	0.6925	238586.	586791.	0.711	254701.	604046.	322300.	592170.

SIMULATION IIIB

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.0

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS	FNDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	211.6	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.	592170.
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.
5	65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.	592170.
6	65	59845.	4626.	12.9	5267.	2701.	10221.	12921.	1.0000	153146.	57881.	0.274	76378.	181137.	49959.	592170.
7	65	59845.	5308.	11.3	6212.	2836.	10732.	13567.	1.0000	158320.	68130.	0.301	80197.	190194.	59600.	592170.
8	65	59845.	5960.	10.0	7175.	2977.	11268.	14266.	1.0000	163628.	78607.	0.325	84207.	199704.	69423.	592170.
9	65	59845.	6582.	9.1	8156.	3126.	11832.	14958.	1.0000	169072.	89340.	0.346	88417.	209689.	72855.	592170.
10	65	59845.	7171.	8.3	9152.	3283.	12423.	15706.	1.0000	174650.	100360.	0.365	92838.	220173.	80765.	592170.
11	65	59845.	7726.	7.7	10165.	3447.	13044.	16491.	1.0000	180364.	111703.	0.382	97480.	231181.	88667.	592170.
12	65	59845.	8247.	7.3	11195.	3619.	13696.	17316.	1.0000	186213.	123409.	0.399	102553.	242740.	96572.	592170.
13	65	59845.	8732.	6.9	12239.	3800.	14381.	18181.	1.0000	192195.	135522.	0.414	107471.	254877.	104500.	592170.
14	65	59845.	9181.	6.5	13300.	3990.	15100.	19047.	1.0000	198311.	148088.	0.428	112844.	267620.	112470.	592170.
15	65	59845.	9593.	6.2	14377.	4190.	15855.	20005.	1.0000	204557.	161161.	0.441	118487.	281001.	120505.	592170.
16	65	59845.	9967.	6.0	15470.	4399.	16648.	21047.	1.0000	210932.	174796.	0.453	124411.	295051.	128629.	592170.
17	65	59845.	10304.	5.8	16580.	4619.	17480.	22099.	1.0000	217434.	189055.	0.465	130631.	309803.	136872.	592170.
18	65	59845.	10604.	5.6	17709.	4850.	18354.	23204.	1.0000	224058.	204003.	0.477	137163.	325293.	145263.	592170.
19	65	59845.	10869.	5.5	18860.	5092.	19272.	23465.	1.0000	230801.	219708.	0.488	144021.	341557.	153837.	592170.
20	65	59845.	11100.	5.4	20034.	5347.	20236.	23583.	1.0000	237658.	236242.	0.499	151221.	358635.	162626.	592170.
21	65	59845.	11299.	5.3	21235.	5614.	21247.	23682.	1.0000	244624.	253681.	0.509	158782.	376566.	171668.	592170.
22	65	59845.	11470.	5.2	22467.	5895.	22310.	23820.	1.0000	251692.	272103.	0.519	166721.	395394.	180977.	592170.
23	65	59845.	11616.	5.2	23746.	6190.	23431.	23921.	1.0000	258950.	291583.	0.530	175057.	415163.	190745.	592170.
24	65	59845.	11736.	5.1	25089.	6499.	24623.	31123.	1.0009	266534.	312196.	0.539	183810.	435921.	201089.	592170.
25	65	59845.	11834.	5.1	26513.	6824.	25895.	32719.	1.0021	274533.	334012.	0.549	193000.	457716.	212151.	592170.
26	65	59845.	11914.	5.0	28031.	7166.	27253.	34419.	1.0040	282996.	357100.	0.558	202650.	480602.	224012.	592170.
27	65	59845.	11977.	5.0	29654.	7524.	28704.	36228.	1.0064	291950.	381529.	0.567	212782.	504631.	236725.	592170.
28	65	59845.	12027.	5.0	31392.	7900.	30254.	38154.	1.0094	301421.	407367.	0.575	223421.	529862.	250337.	592170.
29	65	59845.	12066.	5.0	33252.	8295.	31908.	40203.	1.0118.	311418.	434686.	0.583	234592.	556355.	264880.	592170.
30	65	59845.	12096.	4.9	35236.	8710.	33669.	42379.	1.0170	321914.	463562.	0.590	246321.	584172.	280348.	592170.
31	65	59845.	12118.	4.9	37353.	9145.	35366.	44317.	0.8383	332923.	486069.	0.593	258637.	613380.	296779.	592170.
32	65	59845.	12134.	4.9	39602.	9603.	37129.	46311.	0.8430	342830.	509501.	0.591	271569.	644048.	314175.	592170.
33	65	59845.	12146.	4.9	41988.	10083.	39025.	48098.	0.8480	352706.	533896.	0.588	285147.	676250.	332553.	592170.
34	65	59845.	12154.	4.9	44515.	10587.	40930.	50027.	0.8532	362655.	559293.	0.585	299404.	710062.	351944.	592170.
35	65	59845.	12159.	4.9	47183.	11116.	42849.	52073.	0.8586	372673.	585739.	0.582	314374.	745565.	372364.	592170.
36	65	59845.	12163.	4.9	49999.	11672.	45866.	54259.	0.8642	383171.	613284.	0.579	330092.	782842.	393854.	592170.
37	65	59845.	12165.	4.9	52966.	12256.	48748.	56704.	0.8699	394208.	641986.	0.576	346596.	821983.	416447.	592170.
38	65	59845.	12167.	4.9	56088.	12869.	51041.	59309.	0.8756	405847.	671907.	0.572	363926.	863002.	441088.	592170.
39	65	59845.	12167.	4.9	59372.	13512.	53470.	62093.	0.8815	418158.	703137.	0.569	382122.	906235.	465130.	592170.
40	65	59845.	12168.	4.9	62823.	14188.	56044.	65232.	0.8874	431211.	735677.	0.566	401227.	951545.	491325.	592170.
41	65	59845.	12168.	4.9	66450.	14897.	58769.	68666.	0.8933	444836.	769677.	0.563	421288.	999122.	518835.	592170.
42	65	59845.	12168.	4.9	70260.	15642.	61653.	72295.	0.8993	459088.	805195.	0.560	442352.	1049077.	547725.	592170.
43	65	59845.	12168.	4.9	74263.	16424.	64704.	75712.	0.9052	474169.	842320.	0.556	464469.	1101529.	578064.	592170.
44	65	59845.	12168.	4.9	78467.	17246.	67931.	79176.	0.9112	489844.	881144.	0.553	487692.	1156604.	609926.	592170.
45	65	59845.	12168.	4.9	82884.	18108.	71342.	82950.	0.9171	506147.	921267.	0.550	512076.	1214433.	643389.	592170.
46	65	59845.	12168.	4.9	87523.	19013.	74948.	86961.	0.9230	523097.	964293.	0.547	537680.	1275154.	678537.	592170.
47	65	59845.	12168.	4.9	91908.	19964.	78854.	91343.	0.9270	540747.	1009136.	0.545	564563.	1338911.	712489.	592170.
48	65	59845.	12168.	4.9	96510.	20962.	83088.	96343.	0.9308	559369.	1056426.	0.544	592791.	1405854.	748131.	592170.
49	65	59845.	12168.	4.9	101340.	22010.	87378.	101389.	0.9344	579633.	1106295.	0.542	622429.	1476145.	785549.	592170.

SIMULATION IVA

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL	PAST	SVG	TOTAL	% OF	UNFUNDED	FUNDS	FNDOD	PAY	PVFB	PVFB	PVF
AGE						COST	COST	COST	COST	PAY	PAST		RATIO		ACTIVES	RETIRED	SERVICE
1	45	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.		9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8246.	10428.	1.0000	131192.		18531.	0.124	61640.	146186.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.		27705.	0.171	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.		36823.	0.214	65394.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.		45893.	0.251	67355.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.		54924.	0.284	69376.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.		63927.	0.313	71457.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.		72915.	0.340	73601.	174551.	60026.	592170.
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	1.0030	143857.		81870.	0.363	75809.	179787.	67154.	592170.
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	1.0075	146266.		90789.	0.383	78083.	185181.	74369.	592170.
11	64	59845.	8570.	7.0	10471.	3155.	11986.	15141.	1.1128	165713.		99999.	0.376	80425.	199562.	92370.	586002.
12	64	59845.	9091.	6.6	11440.	3252.	12416.	15668.	1.1180	168359.		109227.	0.393	82838.	205600.	99596.	586051.
13	64	59845.	9576.	6.2	12427.	3351.	12875.	16227.	1.1242	171145.		118488.	0.409	85233.	211823.	106833.	586091.
14	64	59845.	10029.	6.0	13417.	3454.	13357.	16811.	1.1307	173952.		127806.	0.424	87883.	218235.	113959.	586125.
15	64	59845.	10437.	5.7	14407.	3560.	13860.	17420.	1.1376	176754.		137209.	0.437	90519.	224844.	120971.	586154.
16	64	59845.	10811.	5.5	15395.	3668.	14387.	18055.	1.1447	179530.		146729.	0.450	93235.	231656.	128773.	586180.
17	64	59845.	11148.	5.4	16377.	3780.	14935.	18715.	1.1520	182257.		156404.	0.462	96032.	238679.	134670.	586204.
18	64	59845.	11448.	5.2	17352.	3895.	15507.	19402.	1.1595	184912.		166274.	0.473	98913.	245917.	141373.	586226.
19	64	59845.	11713.	5.1	18318.	4013.	16101.	20114.	1.1670	187470.		176385.	0.485	101880.	253379.	147994.	586246.
20	63	59845.	12804.	4.7	20663.	4574.	18110.	22664.	1.2778	212366.		187225.	0.469	104936.	272369.	169527.	579994.
21	63	59845.	13003.	4.6	21654.	4715.	18790.	23505.	1.2855	214943.		198437.	0.480	108084.	280723.	176506.	580047.
22	63	59845.	13173.	4.5	22639.	4860.	19495.	24355.	1.2932	217341.		210074.	0.492	111327.	289341.	183469.	580087.
23	63	59845.	13320.	4.5	23623.	5010.	20226.	25236.	1.3009	219531.		222190.	0.503	114666.	298232.	190440.	580115.
24	63	59845.	13440.	4.5	24599.	5163.	20983.	26146.	1.3086	221484.		234847.	0.515	118106.	307406.	197432.	580133.
25	63	59845.	13538.	4.4	25573.	5322.	21766.	27087.	1.3162	223171.		248103.	0.526	121649.	316873.	204475.	580141.
26	63	59845.	13617.	4.4	26548.	5484.	22576.	28061.	1.3238	224558.		262021.	0.538	125299.	326643.	211589.	580140.
27	63	59845.	13681.	4.4	27526.	5652.	23415.	29076.	1.3313	225631.		276663.	0.551	129058.	336726.	218796.	580131.
28	63	59845.	13731.	4.4	28511.	5824.	24282.	30106.	1.3387	226300.		292090.	0.563	132929.	347139.	226116.	580112.
29	62	59845.	14645.	4.1	31368.	6619.	27036.	33655.	1.4530	256581.		308981.	0.546	136917.	372451.	254226.	573650.
30	62	59845.	14674.	4.1	32434.	6823.	28015.	34838.	1.4602	256815.		326834.	0.560	141024.	384126.	262520.	573640.
31	62	59845.	14696.	4.1	33517.	7039.	21019.	28051.	1.4415	256582.		337709.	0.568	145255.	396189.	270959.	573610.
32	62	59845.	14713.	4.1	34620.	7249.	21823.	29072.	1.4486	264189.		349046.	0.569	149612.	408656.	279603.	573559.
33	62	59845.	14724.	4.1	35746.	7471.	22655.	30072.	1.4566	271915.		360879.	0.570	154101.	421542.	288466.	573486.
34	62	59845.	14732.	4.1	36897.	7700.	23516.	31216.	1.4625	279734.		373241.	0.572	158724.	434863.	297565.	573391.
35	62	59845.	14738.	4.1	38077.	7935.	24406.	32341.	1.4693	287366.		386167.	0.573	163485.	448636.	306912.	573270.
36	62	59845.	14741.	4.1	39286.	8177.	25327.	33504.	1.4761	295616.		399692.	0.575	168389.	462879.	316519.	573121.
37	62	59845.	14744.	4.1	40528.	8426.	26279.	34705.	1.4828	303665.		413853.	0.577	173441.	477610.	326399.	572945.
38	62	59845.	14745.	4.1	41804.	8682.	27263.	35945.	1.4894	311776.		428687.	0.579	178404.	492850.	336563.	572741.
39	62	59845.	14746.	4.1	43116.	8946.	28244.	37189.	1.4947	319936.		444194.	0.581	184003.	508618.	347021.	572509.
40	62	59845.	14746.	4.1	44465.	9217.	29234.	38452.	1.4993	328117.		460391.	0.584	189523.	524937.	357784.	572250.
41	62	59845.	14747.	4.1	45853.	9497.	29198.	38695.	1.4717	336515.		476252.	0.586	195209.	541829.	368862.	572160.
42	62	59845.	14747.	4.1	47281.	9785.	30216.	40001.	1.4760	346058.		492784.	0.587	201065.	559318.	380267.	571639.
43	62	59845.	14747.	4.1	48752.	10081.	31253.	41334.	1.4798	355783.		510005.	0.589	207097.	577429.	392008.	571281.
44	62	59845.	14747.	4.1	50265.	10386.	32318.	42703.	1.4834	365707.		527943.	0.591	213309.	596189.	404096.	570885.
45	62	59845.	14747.	4.1	51824.	10700.	33411.	44111.	1.4868	375837.		546627.	0.593	219708.	615625.	415625.	570448.
46	62	59845.	14747.	4.1	53428.	11023.	34535.	45558.	1.4900	386148.		566088.	0.594	226300.	635767.	429358.	569970.
47	62	59845.	14747.	4.1	55031.	11356.	35672.	47028.	1.4926	396437.		586389.	0.597	233088.	656647.	442238.	569453.
48	62	59845.	14986.	4.0	57640.	11696.	36841.	48538.	1.4951	406886.		606607.	0.599	240081.	668300.	465981.	571349.
49	62	59845.	14994.	4.0	59401.	12052.	38038.	50090.	1.4973	417465.		627626.	0.601	247283.	689421.	480012.	571195.
50	62	59845.	15002.	4.0	61212.	12417.	37876.	50293.	1.4672	428219.		648087.	0.602	254701.	711264.	494423.	570928.

SIMULATION IVB

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDOD RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE	
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.	592170.
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.
5	65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.	592170.
6	65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57851.	0.273	76378.	181137.	49567.	592170.
7	65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160275.	68001.	0.298	80197.	190194.	58884.	592170.
8	65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.	592170.
9	65	59845.	6582.	9.1	8809.	3126.	12197.	15324.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.	592170.
10	65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.	592170.
11	64	59845.	8570.	7.0	12676.	3824.	15024.	18848.	1.1429	211991.	110433.	0.343	97480.	241879.	111813.	586002.
12	64	59845.	9091.	6.6	14135.	4018.	15952.	19970.	1.1533	221797.	121790.	0.354	102353.	254035.	123060.	586051.
13	64	59845.	9576.	6.2	15653.	4221.	16944.	21166.	1.1641	232152.	133392.	0.365	107471.	266805.	134565.	586091.
14	64	59845.	10025.	6.0	17228.	4435.	18003.	22438.	1.1753	243052.	145271.	0.374	112844.	280220.	146327.	586125.
15	64	59845.	10437.	5.7	18859.	4659.	19130.	23789.	1.1868	254495.	157465.	0.382	118487.	294313.	158347.	586154.
16	64	59845.	10811.	5.5	20542.	4894.	20328.	25222.	1.1984	266476.	170018.	0.390	124411.	309118.	170631.	586180.
17	64	59845.	11148.	5.4	22277.	5141.	21601.	27179.	1.2100	278990.	182983.	0.396	130631.	324672.	183191.	586204.
18	64	59845.	11448.	5.2	24061.	5400.	22950.	28349.	1.2217	292032.	196419.	0.402	137163.	340104.	196043.	586226.
19	64	59845.	11713.	5.1	25895.	5671.	24378.	30050.	1.2333	305595.	210395.	0.408	144021.	358184.	209209.	586246.
20	63	59845.	12804.	4.7	29777.	6589.	27895.	34483.	1.3479	352039.	225622.	0.391	151221.	392506.	244302.	579994.
21	63	59845.	13003.	4.6	31812.	6924.	29588.	36512.	1.3592	367688.	241603.	0.397	158782.	412399.	259298.	580047.
22	63	59845.	13173.	4.5	33904.	7275.	31377.	38652.	1.3704	383874.	258430.	0.402	166721.	433313.	274761.	580087.
23	63	59845.	13320.	4.5	36065.	7644.	33265.	40908.	1.3813	400591.	276195.	0.408	175057.	455300.	290737.	580115.
24	63	59845.	13440.	4.5	38283.	8030.	35256.	43286.	1.3920	417832.	295008.	0.414	183810.	478418.	307266.	580133.
25	63	59845.	13538.	4.4	40572.	8436.	37355.	45792.	1.4025	435592.	314978.	0.420	193050.	502728.	324405.	580141.
26	63	59845.	13617.	4.4	42937.	8862.	39568.	48430.	1.4127	453862.	334220.	0.426	202650.	528291.	342210.	580140.
27	63	59845.	13681.	4.4	45384.	9309.	41899.	51209.	1.4226	472636.	353856.	0.432	212782.	555174.	360737.	580131.
28	63	59845.	13731.	4.4	47920.	9778.	44355.	54133.	1.4322	491906.	373854.	0.438	223421.	583448.	380045.	580112.
29	62	59845.	14645.	4.1	53746.	11329.	49125.	61453.	1.5465	563059.	409869.	0.421	234592.	638153.	435662.	573650.
30	62	59845.	14674.	4.1	56651.	11904.	52000.	64906.	1.5575	585000.	438616.	0.428	246321.	670936.	458533.	573640.
31	62	59845.	14696.	4.1	59679.	12507.	54970.	68020.	1.5688.	607476.	461395.	0.432	258637.	705444.	482462.	573610.
32	62	59845.	14713.	4.1	62840.	13141.	58088.	71529.	1.5798.	630884.	485735.	0.432	271569.	741771.	507520.	573559.
33	62	59845.	14724.	4.1	66144.	13805.	61453.	75344.	1.4003	671581.	511256.	0.432	285147.	780018.	533777.	573486.
34	62	59845.	14732.	4.1	69600.	14502.	65835.	79337.	1.4084	705929.	538555.	0.433	299404.	820292.	561304.	573391.
35	62	59845.	14738.	4.1	73220.	15234.	70091.	83424.	1.4163	741471.	567587.	0.434	314374.	862705.	590177.	573270.
36	62	59845.	14741.	4.1	77013.	16002.	74381.	87948.	1.4233	778636.	598436.	0.435	330092.	907377.	620469.	573121.
37	62	59845.	14744.	4.1	80990.	16807.	79077.	92841.	1.4294	817425.	631182.	0.436	346596.	954344.	652261.	572945.
38	62	59845.	14745.	4.1	85161.	17653.	83552.	97511.	1.4351	857951.	665931.	0.437	363926.	1004011.	685630.	572741.
39	62	59845.	14746.	4.1	89539.	18541.	88003.	102056.	1.4403	900312.	702795.	0.438	382122.	1056252.	720661.	572509.
40	62	59845.	14746.	4.1	94133.	19473.	88200.	107481.	1.4451	946608.	741894.	0.440	401227.	1111309.	757440.	572250.
41	62	59845.	14747.	4.1	98957.	20451.	91605.	112056.	1.4319	990951.	782087.	0.441	421288.	1169344.	790507.	571961.
42	62	59845.	14747.	4.1	104021.	21478.	96003.	117481.	1.4362	1040779.	824651.	0.442	442352.	1230526.	836605.	571639.
43	62	59845.	14747.	4.1	109329.	22556.	100617.	123174.	1.4403	1093051.	869718.	0.443	464469.	1295039.	879182.	571281.
44	62	59845.	14747.	4.1	114922.	23688.	95462.	129150.	1.4441	1147792.	917430.	0.444	487492.	1363075.	923890.	570885.
45	62	59845.	14747.	4.1	120786.	24876.	100549.	135425.	1.4478	1205559.	967941.	0.445	512076.	1434843.	970839.	570448.
46	62	59845.	14747.	4.1	126943.	26123.	105894.	142018.	1.4514	1262559.	1021412.	0.447	537680.	1510560.	1020139.	569970.
47	62	59845.	14747.	4.1	133290.	27433.	111464.	148897.	1.4543	1328089.	1078089.	0.448	564563.	1590464.	1071145.	569453.
48	62	59845.	14986.	4.0	143220.	28806.	117315.	146121.	1.4571	1393660.	1135793.	0.449	592791.	1650141.	1150569.	571434.
49	62	59845.	14994.	4.0	149516.	30253.	123448.	153701.	1.4597	1462213.	1196787.	0.450	622429.	1735325.	1208277.	571195.
50	62	59845.	15002.	4.0	157068.	31773.	127880.	159653.	1.4440	1534007.	1259189.	0.451	653550.	1825667.	1268663.	570928.

SIMULATION VA

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL COST	PAST COST	SYC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SYC	FUNDS RATIO	FUNDS FNOED	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.	
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.	
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.	
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.	
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.	45893.	0.251	67355.	159739.	39218.	592170.	
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.	54924.	0.284	69376.	164531.	46394.	592170.	
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.	63927.	0.313	71457.	169467.	53339.	592170.	
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.	72915.	0.340	73601.	174551.	60062.	592170.	
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	1.0030	143857.	81870.	0.363	75809.	179787.	67154.	592170.	
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	1.0075	146266.	90789.	0.383	78083.	185181.	74369.	592170.	
11	64	59845.	8570.	7.0	10471.	3155.	11986.	15141.	1.1128	165713.	99999.	0.376	80425.	195622.	92370.	586002.	
12	64	59845.	9091.	6.6	11440.	3252.	12416.	15668.	1.1180	168355.	109227.	0.393	82838.	205600.	99596.	586051.	
13	64	59845.	9576.	6.2	12427.	3351.	12875.	16227.	1.1242	171145.	118488.	0.409	85323.	211822.	106833.	586091.	
14	63	59845.	10885.	5.5	14570.	3821.	14512.	18333.	1.2331	192598.	128175.	0.400	87883.	227655.	123681.	579884.	
15	63	59845.	11297.	5.3	15597.	3940.	15048.	18988.	1.2399	195638.	137975.	0.414	90519.	234615.	133788.	579955.	
16	63	59845.	11671.	5.1	16621.	4062.	15607.	19669.	1.2470	198648.	147921.	0.427	93235.	241794.	141096.	580013.	
17	62	59845.	12882.	4.6	18928.	4621.	17467.	22088.	1.3596	222216.	158477.	0.416	96032.	259240.	162592.	573742.	
18	62	59845.	13182.	4.5	19983.	4765.	18110.	22875.	1.3670	225361.	169293.	0.429	98913.	267272.	170178.	573817.	
19	62	59845.	13447.	4.5	21031.	4913.	18778.	23692.	1.3746	228399.	180418.	0.441	101880.	275565.	177710.	573876.	
20	61	59845.	14567.	4.1	23506.	5576.	20883.	26459.	1.4904	254077.	192392.	0.431	104936.	294828.	201565.	567507.	
21	61	59845.	14766.	4.1	24586.	5750.	21643.	27393.	1.4981	257118.	204818.	0.443	108084.	304114.	205552.	567563.	
22	61	59845.	14936.	4.0	25663.	5930.	22431.	28361.	1.5059	260170.	217757.	0.456	111327.	313713.	215566.	567598.	
23	60	59845.	15984.	3.7	28335.	6714.	24806.	31521.	1.6249	287755.	231830.	0.446	114666.	335061.	242491.	561081.	
24	60	59845.	16104.	3.7	29458.	6924.	25696.	32620.	1.6326	290463.	246584.	0.459	118106.	345828.	252974.	561084.	
25	60	59845.	16202.	3.7	30584.	7139.	26618.	33758.	1.6403	292882.	262087.	0.472	121649.	356973.	261757.	561058.	
26	59	59845.	17195.	3.5	33485.	8067.	29296.	37363.	1.7626	322802.	279070.	0.464	125299.	380754.	291663.	554323.	
27	59	59845.	17259.	3.5	34680.	8318.	30332.	38651.	1.7703	324908.	296994.	0.478	129058.	393288.	301682.	554230.	
28	59	59845.	17309.	3.5	35889.	8577.	31405.	39982.	1.7779	326617.	315936.	0.492	132929.	406283.	311590.	554097.	
29	58	59845.	18273.	3.3	39078.	9678.	34437.	44115.	1.9046	358917.	336770.	0.484	136917.	433187.	345928.	547054.	
30	58	59845.	18303.	3.3	40384.	9977.	35641.	45617.	1.9121	360125.	358841.	0.499	141024.	447861.	357032.	546815.	
31	58	59845.	18325.	3.3	41715.	10284.	28878.	39162.	1.5937	360810.	374230.	0.509	145255.	463104.	368409.	546526.	
32	58	59845.	18341.	3.3	43074.	10601.	29927.	40527.	1.6012	369335.	390395.	0.514	149612.	478947.	380080.	546184.	
33	58	59845.	18353.	3.3	44463.	10926.	31013.	41940.	1.6087	377916.	407390.	0.519	154101.	495416.	392062.	545790.	
34	58	59845.	18361.	3.3	45886.	11261.	32140.	43401.	1.6163	386542.	425274.	0.524	158724.	512545.	404372.	545339.	
35	58	59845.	18366.	3.3	47345.	11605.	33307.	44912.	1.6239	395200.	444104.	0.529	163485.	530364.	417027.	544826.	
36	58	59845.	18370.	3.3	48843.	11959.	34517.	46476.	1.6315	403878.	463942.	0.535	168389.	548909.	430041.	544245.	
37	58	59845.	18372.	3.3	50382.	12324.	35771.	48095.	1.6391	412563.	484852.	0.540	173441.	568216.	443200.	543590.	
38	58	59845.	18374.	3.3	51964.	12699.	37070.	49769.	1.6468	421242.	506899.	0.546	178644.	588324.	457208.	542856.	
39	58	59845.	18374.	3.3	53591.	13085.	38380.	51465.	1.6533	429899.	530119.	0.552	184003.	609274.	471389.	542037.	
40	58	59845.	18375.	3.3	55264.	13483.	39715.	53198.	1.6592	438558.	554558.	0.558	189523.	631110.	485987.	541129.	
41	58	59845.	18375.	3.3	56987.	13892.	40040.	55392.	1.6631	447228.	579230.	0.564	195209.	653881.	501015.	540125.	
42	58	59845.	18375.	3.3	58760.	14313.	41435.	57468.	1.6389	457013.	605180.	0.570	201065.	677366.	516488.	539022.	
43	58	59845.	18375.	3.3	60586.	14747.	42867.	57614.	1.6445	466883.	632467.	0.575	207097.	702429.	532419.	537814.	
44	58	59845.	18628.	3.2	63366.	15192.	43191.	58382.	1.6178	476847.	659106.	0.580	213309.	725458.	559736.	539127.	
45	58	59845.	18638.	3.2	65362.	15652.	44681.	60333.	1.6232	488048.	687031.	0.585	219708.	747371.	577106.	538077.	
46	58	59845.	18648.	3.2	67417.	16126.	46221.	62347.	1.6285	499410.	716133.	0.589	226300.	770513.	594963.	536927.	
47	58	59845.	18914.	3.2	70473.	16613.	46508.	63121.	1.6007	510507.	744775.	0.593	233088.	787038.	625042.	538351.	
48	58	59845.	18933.	3.2	72655.	17116.	48082.	65199.	1.6053	522995.	774597.	0.597	240081.	814686.	644010.	537376.	
49	58	59845.	18951.	3.2	74900.	17636.	49706.	67342.	1.6097	535646.	805726.	0.601	247283.	843499.	663477.	536307.	
50	58	59845.	19230.	3.1	78323.	18169.	49972.	68140.	1.5814	548495.	835829.	0.604	254701.	868045.	696959.	537866.	

SIMULATION VB

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

446

T RET AGE	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1 65	59845.	827.	72.4	827.	2116.	8009.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.
2 65	59845.	1634.	36.6	1675.	2232.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.
3 65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156874.	24688.
4 65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.
5 65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.
6 65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57851.	0.273	76378.	181137.	49567.
7 65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160275.	68001.	0.298	80197.	190194.	58884.
8 65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.
9 65	59845.	6582.	9.1	8809.	3126.	12197.	15324.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.
10 65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.
11 64	59845.	8570.	7.0	12676.	3824.	15024.	18848.	1.1429	211991.	110433.	0.343	97480.	241879.	111813.
12 64	59845.	9091.	6.6	14135.	4018.	15952.	19970.	1.1533	221797.	121790.	0.354	102353.	254035.	123060.
13 64	59845.	9576.	6.2	15653.	4221.	16944.	21166.	1.1641	232152.	133392.	0.365	107471.	266805.	134565.
14 63	59845.	10885.	5.5	18709.	4906.	19486.	24392.	1.2777	266994.	145745.	0.353	112844.	292316.	162277.
15 63	59845.	11297.	5.3	20416.	5156.	20684.	25841.	1.2892	279223.	158457.	0.362	118487.	307103.	175123.
16 63	59845.	11671.	5.1	22179.	5419.	21958.	27377.	1.3007	292018.	171578.	0.370	124411.	322646.	188276.
17 62	59845.	12882.	4.6	25747.	6284.	25046.	31330.	1.4177	333414.	185739.	0.358	130631.	352641.	221173.
18 62	59845.	13182.	4.5	27710.	6605.	26562.	33167.	1.4294	348252.	200484.	0.365	137163.	370627.	235987.
19 62	59845.	13447.	4.5	29730.	6943.	28167.	35110.	1.4410	363677.	215887.	0.372	144021.	389547.	251216.
20 61	59845.	14567.	4.1	33874.	8031.	31897.	39929.	1.5608	412498.	232736.	0.361	151221.	424870.	290471.
21 61	59845.	14766.	4.1	36119.	8443.	33789.	42232.	1.5722	430166.	250485.	0.368	158782.	446763.	307845.
22 61	59845.	14936.	4.0	38433.	8874.	35787.	44661.	1.5834	448449.	269237.	0.375	166721.	469812.	325809.
23 60	59845.	15984.	3.7	43258.	10242.	40276.	50518.	1.7058	505751.	289960.	0.364	175057.	511526.	372951.
24 60	59845.	16104.	3.7	45845.	10766.	42617.	53383.	1.7167	526252.	311995.	0.372	183810.	538215.	393705.
25 60	59845.	16202.	3.7	48522.	11315.	45086.	56401.	1.7274	547957.	335473.	0.380	193000.	566348.	415284.
26 59	59845.	17195.	3.5	54156.	13033.	50477.	63510.	1.8525	615043.	361601.	0.370	202650.	619807.	472203.
27 59	59845.	17259.	3.5	57178.	13698.	53358.	67056.	1.8628	639284.	389558.	0.379	212782.	648429.	497399.
28 59	59845.	17309.	3.5	60320.	14396.	56395.	70790.	1.8729	664242.	419506.	0.387	223421.	682861.	523705.
29 58	59845.	18273.	3.3	66956.	16558.	62890.	79448.	2.0019	743085.	452973.	0.379	234592.	742218.	547054.
30 58	59845.	18303.	3.3	70377.	17399.	66426.	83825.	2.0116	771270.	488909.	0.388	246321.	782259.	546815.
31 58	59845.	18325.	3.3	74277.	18281.	70246.	88427.	2.0318	800264.	519505.	0.394	258637.	824892.	546526.
32 58	59845.	18341.	3.3	78195.	19207.	73677.	93854.	1.8478	838483.	552179.	0.397	271569.	869359.	689901.
33 58	59845.	18353.	3.3	82274.	20178.	76903.	99840.	1.8570	878368.	587094.	0.401	285147.	916715.	725469.
34 58	59845.	18361.	3.3	86556.	21197.	79334.	94321.	1.8663	919989.	624423.	0.404	299404.	966825.	762776.
35 58	59845.	18366.	3.3	91043.	22267.	77482.	99749.	1.8755	963422.	664350.	0.408	313734.	1019864.	801922.
36 58	59845.	18370.	3.3	95870.	23390.	81822.	105211.	1.8840	1008745.	707031.	0.412	330092.	1076020.	843005.
37 58	59845.	18372.	3.3	100681.	24568.	86357.	110925.	1.8918	1056086.	756227.	0.416	346596.	1135495.	886130.
38 58	59845.	18374.	3.3	105858.	25804.	91124.	116929.	1.8992	1105580.	801328.	0.420	363926.	1198506.	931404.
39 58	59845.	18374.	3.3	111292.	27102.	96137.	123239.	1.9064	1157355.	853340.	0.424	382122.	1262585.	978939.
40 58	59845.	18375.	3.3	116997.	28465.	101410.	129875.	1.9134	1211542.	908885.	0.429	401227.	1336082.	1028850.
41 58	59845.	18375.	3.3	122986.	29895.	105695.	135590.	1.9025	1268286.	966932.	0.433	421288.	1411168.	1081261.
42 58	59845.	18375.	3.3	129275.	31396.	111480.	142876.	1.9092	1329062.	1028879.	0.436	442352.	1490832.	1136297.
43 58	59845.	18375.	3.3	135880.	32973.	117573.	150546.	1.9159	1392834.	1094988.	0.440	464469.	1575385.	1194091.
44 58	59845.	18628.	3.2	144874.	34624.	122513.	157137.	1.9046	1459778.	1162000.	0.443	487692.	1641706.	1279733.
45 58	59845.	18638.	3.2	152340.	36363.	129202.	165655.	1.9112	1531442.	1233324.	0.446	512076.	1733421.	1345067.
46 58	59845.	18648.	3.2	160179.	38189.	136252.	174442.	1.9177	1606696.	1309251.	0.449	537680.	1830711.	1413610.
47 58	59845.	18914.	3.2	170693.	40104.	141884.	181988.	1.9054	1684724.	1386008.	0.451	564563.	1906286.	1513914.
48 58	59845.	18933.	3.2	179395.	42119.	149551.	191670.	1.9112	1768197.	1467582.	0.454	592791.	2011565.	1590144.
49 58	59845.	18951.	3.2	188528.	44236.	157624.	201860.	1.9170	1855783.	1594291.	0.456	622429.	2123151.	1670022.
50 58	59845.	19230.	3.1	200973.	46456.	164094.	210550.	1.9043	1947709.	1641581.	0.457	653550.	2208884.	1788361.

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-RETI	PENSIONS	NORMAL	PAST SVC	TOTAL	% OF	UNFUNDED	FUNDS	FND	PAY	PVFB	PVFB	PVFB
AGE						COST	COST	COST	PAY	PAST SVC	FND	RATIO		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.
5	65	56754.	3916.	14.5	4166.	2259.	9013.	11272.	1.0431	136727.	45770.	0.251	63877.	158417.	39218.	558941.
6	65	53628.	4626.	11.6	5000.	2206.	9283.	11490.	1.0884	138660.	54548.	0.283	62401.	161739.	46394.	527296.
7	65	59845.	5308.	11.3	5832.	2527.	9561.	12088.	0.9999	140118.	63531.	0.312	71457.	169034.	53339.	591640.
8	65	59845.	5960.	10.0	6660.	2602.	9848.	12450.	0.9999	141710.	72497.	0.338	73601.	174087.	60062.	591721.
9	65	59845.	6582.	9.1	7553.	2681.	10180.	12860.	1.0028	143815.	81429.	0.362	75809.	179290.	67154.	591779.
10	65	56748.	7171.	7.9	8484.	2618.	10545.	13163.	1.0508	146209.	90180.	0.381	74043.	183109.	74369.	558531.
11	65	53819.	7726.	7.0	9426.	2557.	10930.	13488.	1.1023	148673.	98751.	0.399	73327.	186937.	81481.	526871.
12	65	59845.	8247.	7.3	10375.	2929.	11377.	14266.	1.0180	151184.	107579.	0.416	82838.	192333.	88483.	591340.
13	65	59845.	8732.	6.9	11329.	3017.	11764.	14781.	1.0240	153733.	116410.	0.431	85232.	201142.	95366.	591441.
14	65	59845.	9181.	6.5	12285.	3108.	12212.	15319.	1.0304	156300.	125265.	0.445	87883.	207120.	102125.	591524.
15	65	56744.	9593.	5.9	13239.	3035.	12681.	15716.	1.0823	158864.	134004.	0.458	85830.	211489.	108761.	558263.
16	65	53811.	9967.	5.4	14190.	2964.	13171.	16135.	1.1377	161400.	142649.	0.469	83834.	215839.	115275.	526594.
17	65	59845.	10304.	5.8	15134.	3396.	13681.	17077.	1.0511	163879.	151724.	0.481	96032.	225553.	121672.	591195.
18	65	59845.	10604.	5.6	16070.	3498.	14213.	17710.	1.0584	166290.	160950.	0.492	98913.	232199.	127962.	591351.
19	65	59845.	10869.	5.5	16996.	3603.	14766.	18368.	1.0657	168606.	170369.	0.503	101880.	239053.	134158.	591493.
20	65	56738.	11100.	5.1	17912.	3518.	15340.	18858.	1.1204	170805.	179834.	0.513	99490.	244032.	140274.	558231.
21	65	53799.	11299.	4.8	18818.	3436.	15936.	19372.	1.1785	172855.	189380.	0.523	97166.	248982.	146328.	526567.
22	65	59845.	11470.	5.2	19713.	3937.	16553.	20490.	1.0879	174724.	199625.	0.533	111327.	260132.	152340.	591351.
23	65	59845.	11616.	5.2	20605.	4055.	17192.	21247.	1.0953	176394.	210247.	0.544	114666.	267753.	158328.	591564.
24	65	59845.	11736.	5.1	21486.	4176.	17853.	22030.	1.1026	177838.	221303.	0.554	118106.	275585.	164310.	591761.
25	65	56734.	11834.	4.8	22362.	4078.	18538.	22616.	1.1592	179028.	232622.	0.565	115327.	281232.	170311.	558512.
26	65	53791.	11914.	4.5	23236.	3983.	19245.	23227.	1.2191	179925.	244244.	0.576	112624.	286834.	176352.	526866.
27	65	59845.	11977.	5.0	24111.	4564.	19974.	24538.	1.1239	180491.	256883.	0.587	129058.	299624.	182454.	591280.
28	65	59845.	12027.	5.0	24989.	4701.	20728.	25429.	1.1307	180705.	270166.	0.599	132929.	308307.	188636.	591238.
29	65	59845.	12066.	5.0	25873.	4842.	21506.	26348.	1.1375	180535.	284149.	0.611	136917.	317225.	194918.	592467.
30	65	59845.	12096.	4.9	26767.	4987.	22309.	27296.	1.1441	179943.	298885.	0.624	141024.	326384.	201316.	592816.
31	65	59845.	12118.	4.9	27672.	5137.	23129.	28266.	0.8247	178891.	306423.	0.631	145255.	335789.	207846.	593189.
32	65	59845.	12134.	4.9	28593.	5291.	23944.	29135.	0.8311	185748.	314186.	0.628	149612.	345445.	214524.	593582.
33	65	59845.	12146.	4.9	29530.	5450.	24788.	30048.	0.8373	192735.	322192.	0.626	154101.	355356.	221364.	593990.
34	65	59845.	12154.	4.9	30488.	5613.	25643.	30966.	0.8434	199851.	330459.	0.623	158724.	365572.	228378.	594220.
35	65	59845.	12159.	4.9	31467.	5781.	26511.	31899.	0.8493	207091.	339004.	0.621	163485.	375965.	235778.	594884.
36	65	59845.	12163.	4.9	32471.	5955.	27384.	32839.	0.8551	214451.	347842.	0.619	168389.	386675.	242954.	595383.
37	65	59845.	12165.	4.9	33501.	6134.	28259.	33792.	0.8607	221926.	356989.	0.617	173441.	397659.	250577.	595903.
38	65	59845.	12167.	4.9	34558.	6318.	29162.	34740.	0.8663	229514.	366460.	0.615	178644.	408921.	258395.	596436.
39	65	59845.	12167.	4.9	35644.	6507.	30088.	35705.	0.8704	237206.	376234.	0.613	184003.	420466.	266438.	596984.
40	65	59845.	12168.	4.9	36761.	6703.	31033.	36751.	0.8738	245039.	386299.	0.612	189523.	432296.	274713.	597558.
41	65	59845.	12168.	4.9	37910.	6904.	32050.	37853.	0.8767	253032.	396656.	0.611	195209.	444418.	283230.	598157.
42	65	59845.	12168.	4.9	39093.	7111.	32800.	39110.	0.8793	261194.	407306.	0.609	201065.	456832.	291996.	598760.
43	65	59845.	12168.	4.9	40310.	7324.	33563.	40388.	0.8816	269534.	418249.	0.608	207097.	469440.	301020.	599367.
44	65	59845.	12168.	4.9	41562.	7544.	34341.	41855.	0.8836	278060.	429485.	0.607	213309.	482545.	310309.	599983.
45	65	59845.	11341.	5.3	39815.	7770.	25135.	32905.	0.8853	286780.	440449.	0.608	219708.	525062.	289507.	591725.
46	65	59845.	10534.	5.7	38013.	8003.	25950.	33962.	0.8871	295931.	462200.	0.610	226300.	571103.	269017.	582766.
47	65	59845.	12102.	4.9	45285.	8244.	26805.	35049.	0.8888	305377.	475074.	0.609	233088.	628200.	340294.	598376.
48	65	59845.	12112.	4.9	46687.	8491.	27654.	36145.	0.8899	314776.	488285.	0.608	240081.	547707.	350878.	598955.
49	65	59845.	12123.	4.9	48129.	8746.	28496.	37266.	0.8908	324394.	501835.	0.607	247283.	562973.	361735.	599533.
50	65	59845.	11303.	5.3	46085.	9008.	29406.	38414.	0.8915	334238.	519255.	0.608	254701.	612948.	337610.	591212.

SIMULATION IB*

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS ENDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.
2	65	59845.	1634.	30.6	1675.	2222.	8409.	10630.	1.0000	133777.	18171.	0.123	62837.	149023.	16501.
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.
5	65	56754.	3916.	14.5	4340.	2439.	9734.	12173.	1.0431	148106.	47703.	0.244	68984.	171084.	40914.
6	65	53828.	4626.	11.6	5335.	2429.	10258.	12687.	1.0916	153748.	57440.	0.272	68700.	178063.	49567.
7	65	59845.	5308.	11.3	6432.	2836.	10852.	13687.	1.0088	160247.	67567.	0.297	80197.	189708.	58884.
8	65	59845.	5960.	10.0	7590.	2977.	11496.	14473.	1.0160	167262.	77828.	0.318	84207.	199773.	68473.
9	65	59845.	6582.	9.1	8809.	3126.	12192.	15319.	1.0241	174797.	88229.	0.335	88417.	209108.	78323.
10	65	56748.	7171.	7.9	10087.	3113.	12943.	16056.	1.0781	182855.	98609.	0.350	80035.	217710.	88422.
11	65	53819.	7726.	7.0	11424.	3100.	13750.	18850.	1.1361	191427.	108964.	0.363	87664.	226552.	98759.
12	65	59845.	8247.	7.3	12819.	3619.	14614.	18233.	1.0530	200504.	119826.	0.374	102353.	241350.	109328.
13	65	59845.	8732.	6.9	14269.	3800.	15538.	19333.	1.0648	210100.	130886.	0.384	107471.	253354.	120120.
14	65	59845.	9181.	6.5	15774.	3990.	16524.	20514.	1.0746	220212.	142170.	0.392	112844.	265949.	131132.
15	65	56744.	9593.	5.9	17330.	3973.	17575.	21548.	1.1337	230835.	153496.	0.399	112349.	276832.	145263.
16	65	53811.	9967.	5.4	18935.	3956.	18692.	22648.	1.1967	241952.	164883.	0.405	111867.	288012.	153820.
17	65	59845.	10304.	5.8	20587.	4619.	19877.	24496.	1.1084	253544.	177036.	0.411	130631.	306793.	165509.
18	65	59845.	10604.	5.6	22285.	4850.	21133.	25983.	1.1197	265624.	189585.	0.416	137163.	321991.	177446.
19	65	59845.	10869.	5.5	24027.	5092.	22463.	27555.	1.1310	278184.	202593.	0.421	144021.	337932.	189650.
20	65	56738.	11100.	5.1	25813.	5070.	23870.	28939.	1.1931	291215.	215849.	0.426	143372.	351669.	202146.
21	65	53799.	11299.	4.8	27644.	5047.	25355.	30402.	1.2590	304692.	229399.	0.430	142742.	365770.	214965.
22	65	59845.	11470.	5.2	29522.	5895.	26922.	32817.	1.1635	318590.	244164.	0.434	166721.	389570.	228142.
23	65	59845.	11616.	5.2	31458.	6190.	28574.	34764.	1.1739	332923.	259678.	0.438	170577.	408769.	241714.
24	65	59845.	11736.	5.1	33439.	6499.	30316.	36816.	1.1839	347682.	276039.	0.443	183810.	428895.	255717.
25	65	56734.	11834.	4.8	35479.	6470.	32151.	38621.	1.2477	362855.	292983.	0.447	182970.	446182.	270204.
26	65	53791.	11914.	4.5	37581.	6441.	34082.	40523.	1.3150	378410.	310574.	0.451	182150.	463907.	285221.
27	65	59845.	11977.	5.0	39753.	7524.	36113.	43637.	1.2122	394313.	329986.	0.456	212782.	494002.	300820.
28	65	59845.	12027.	5.0	42000.	7900.	38248.	46149.	1.2210	410585.	350633.	0.461	223421.	518188.	317051.
29	65	59845.	12066.	5.0	44331.	8295.	40495.	48790.	1.2294	427212.	372624.	0.466	234592.	543530.	33970.
30	65	59845.	12096.	4.9	46752.	8710.	42857.	51567.	1.2375	444176.	396069.	0.471	246321.	570081.	351629.
31	65	59845.	12118.	4.9	49273.	9145.	47331.	54677.	1.0622	461459.	413076.	0.472	258637.	597897.	370085.
32	65	59845.	12134.	4.9	51900.	9603.	49540.	59143.	1.0697	487449.	430973.	0.469	271569.	627033.	389393.
33	65	59845.	12146.	4.9	54643.	10083.	51862.	61944.	1.0768	514559.	449823.	0.466	285147.	657548.	409611.
34	65	59845.	12154.	4.9	57510.	10587.	54301.	54888.	1.0836	542826.	469691.	0.464	299404.	689503.	594420.
35	65	59845.	12159.	4.9	60510.	11116.	56863.	57979.	1.0902	572290.	490644.	0.462	314374.	722963.	653005.
36	65	59845.	12163.	4.9	63653.	11672.	49517.	61189.	1.0957	602992.	512172.	0.460	330092.	757994.	746300.
37	65	59845.	12165.	4.9	66946.	12256.	52610.	64516.	1.1003	635018.	535918.	0.458	346596.	794663.	800741.
38	65	59845.	12167.	4.9	70400.	12869.	55121.	67989.	1.1043	668457.	560303.	0.456	363926.	833035.	866366.
39	65	59845.	12167.	4.9	74023.	13512.	58103.	71615.	1.1078	703389.	585910.	0.454	382122.	873184.	933144.
40	65	59845.	12168.	4.9	77825.	14188.	61215.	75402.	1.1109	739890.	612789.	0.453	401227.	915186.	995758.
41	65	59845.	12168.	4.9	81816.	14897.	64462.	79359.	1.1135	778046.	640965.	0.452	421288.	959118.	111250.
42	65	59845.	12168.	4.9	86006.	15642.	67853.	83495.	1.1157	817940.	670502.	0.450	442352.	1005052.	124205.
43	65	59845.	12168.	4.9	90405.	16424.	71394.	87819.	1.1176	859663.	701440.	0.449	464449.	1053068.	136716.
44	65	59845.	12168.	4.9	95024.	17246.	75093.	92338.	1.1192	903303.	733826.	0.448	487692.	1103249.	149464.
45	65	59845.	11341.	5.3	92796.	18108.	78958.	97065.	1.1205	949662.	774786.	0.449	512076.	1223768.	167456.
46	65	59845.	10534.	5.7	90318.	19013.	83039.	102053.	1.1219	997418.	825260.	0.453	537680.	1356919.	193766.
47	65	59845.	12102.	4.9	109684.	19944.	87340.	107304.	1.1235	1048629.	864142.	0.452	564563.	1290543.	842255.
48	65	59845.	12112.	4.9	115277.	20962.	91797.	112759.	1.1244	1101574.	904831.	0.451	592791.	1352359.	866364.
49	65	59845.	12123.	4.9	121145.	22010.	96459.	118470.	1.1251	1165984.	947360.	0.450	622429.	1417046.	910514.
50	65	59845.	12123.	4.9	127253.	23111.	101334.	124447.	1.1254	1230074.	1000560.	0.453	653560.	1517364.	964280.

SIMULATION IVA*

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

F	RET	AGE	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FND	FND RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	827.	2116.	8000.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.	
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10761.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.	
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.	
5	65	56754.	3916.	14.5	4166.	2259.	9013.	11272.	1.0431	136727.	45770.	0.251	67377.	158417.	39218.	595941.	
6	65	53828.	4626.	11.6	5000.	2206.	9283.	11490.	1.0884	138460.	54548.	0.283	62401.	161739.	46394.	527296.	
7	65	59845.	5308.	11.3	5832.	2527.	9561.	12088.	0.9999	140118.	63531.	0.312	71457.	169034.	53339.	591640.	
8	65	59845.	5960.	10.0	6660.	2602.	9848.	12450.	0.9999	141710.	72497.	0.338	73601.	174087.	60062.	591721.	
9	65	59845.	6582.	9.1	7553.	2681.	10180.	12860.	1.0028	143815.	81429.	0.362	75809.	179290.	67154.	591779.	
10	65	56748.	7171.	7.9	8484.	2618.	10545.	13163.	1.0508	146209.	90180.	0.381	74043.	183109.	74369.	558531.	
11	64	52975.	8570.	6.2	10471.	2793.	11977.	14769.	1.2263	165559.	98987.	0.374	71193.	194865.	92370.	511968.	
12	64	59845.	9091.	6.6	11440.	3252.	12404.	15656.	1.1172	168166.	108153.	0.391	82838.	204306.	99596.	585260.	
13	64	59845.	9576.	6.2	12427.	3351.	12801.	16212.	1.2232	170921.	117346.	0.407	85323.	210431.	106833.	585414.	
14	64	59845.	10025.	6.0	13417.	3454.	13340.	16794.	1.1296	173689.	126990.	0.422	87833.	216738.	113959.	585540.	
15	64	56701.	10437.	5.4	14407.	3373.	13841.	17214.	1.1864	176449.	135725.	0.435	85765.	221234.	120971.	551980.	
16	64	53727.	10811.	5.0	15395.	3294.	14363.	17658.	1.2470	179175.	144774.	0.447	83704.	225702.	127873.	520043.	
17	64	59845.	11148.	5.4	16377.	3780.	14907.	18487.	1.503	181837.	156324.	0.459	91632.	236151.	134670.	585347.	
18	64	59845.	11448.	5.2	17352.	3895.	15474.	19369.	1.1575	184422.	164057.	0.471	98913.	243198.	141373.	585534.	
19	64	59845.	11713.	5.1	18318.	4013.	16063.	20077.	1.1648	186905.	174019.	0.482	101880.	250450.	147994.	585707.	
20	63	55817.	12804.	4.4	20663.	4269.	18046.	22315.	1.3472	211390.	184372.	0.466	97909.	265639.	165527.	537038.	
21	63	52859.	13003.	4.1	21654.	4168.	18719.	22886.	1.4170	213866.	194822.	0.477	95468.	270787.	176506.	505260.	
22	63	59845.	13173.	4.5	22639.	4860.	19415.	24275.	1.2889	216139.	206198.	0.488	113327.	284307.	183469.	597638.	
23	63	59845.	13320.	4.5	23623.	5010.	20136.	25145.	1.2962	218197.	218030.	0.500	114666.	292811.	190440.	579922.	
24	63	59845.	13440.	4.5	24599.	5163.	20882.	26045.	1.3035	220008.	230378.	0.512	118106.	301564.	197432.	580178.	
25	63	56651.	13538.	4.2	25573.	5040.	21654.	26694.	1.3702	221543.	243017.	0.523	115158.	307570.	204475.	546350.	
26	63	53630.	13617.	3.9	26548.	4920.	22451.	27371.	1.4009	222758.	255991.	0.535	112287.	313508.	211589.	514183.	
27	63	59845.	13681.	4.4	27526.	5651.	23275.	28926.	1.3249	223612.	270191.	0.547	129058.	328419.	218796.	580419.	
28	63	59845.	13731.	4.4	28511.	5824.	24125.	29949.	1.3318	224084.	285138.	0.560	132929.	338184.	226116.	580763.	
29	62	59845.	14645.	4.1	31368.	6618.	26800.	33418.	1.4427	253122.	301444.	0.544	136917.	361850.	254269.	575101.	
30	62	59845.	14674.	4.1	32434.	6823.	27557.	34580.	1.4494	253922.	318662.	0.557	141024.	372699.	262520.	575508.	
31	62	59845.	14696.	4.1	33517.	7033.	28037.	37770.	1.1301	252557.	328848.	0.566	145255.	383872.	270959.	575924.	
32	62	59845.	14713.	4.1	34620.	7248.	28518.	28766.	1.1365	259883.	339437.	0.566	149612.	395378.	279603.	576344.	
33	62	59845.	14724.	4.1	35746.	7471.	29234.	29794.	1.1429	267285.	350547.	0.567	154101.	407226.	288466.	576765.	
34	62	59845.	14732.	4.1	36897.	7699.	29156.	30855.	1.1491	274756.	361937.	0.568	158724.	419426.	297565.	577192.	
35	62	59845.	14738.	4.1	38077.	7934.	24015.	31949.	1.1552	282286.	373066.	0.570	163485.	431940.	306912.	577633.	
36	62	59845.	14741.	4.1	39286.	8176.	24902.	33078.	1.1612	289876.	386393.	0.571	168389.	444928.	316199.	578088.	
37	62	59845.	14744.	4.1	40528.	8425.	25819.	34244.	1.1671	297488.	399428.	0.573	173441.	458249.	326399.	578541.	
38	62	59845.	14745.	4.1	41804.	8681.	26764.	35445.	1.1728	305139.	413040.	0.575	178644.	471963.	336563.	578982.	
39	62	59845.	14746.	4.1	43116.	8945.	27703.	36648.	1.1773	312805.	427224.	0.577	184003.	486080.	347021.	579414.	
40	62	59845.	14747.	4.1	44465.	9216.	28649.	37865.	1.1810	320515.	441985.	0.580	189523.	500615.	357784.	579848.	
41	62	59845.	14747.	4.1	45853.	9496.	28569.	38065.	1.1526	328282.	456296.	0.582	195209.	515799.	368862.	580284.	
42	62	59845.	13872.	4.3	44343.	9786.	29536.	39321.	1.1560	337206.	474089.	0.584	201065.	531614.	348139.	571412.	
43	62	59845.	13012.	4.6	42763.	10079.	30531.	40611.	1.1591	346496.	495641.	0.589	207097.	541457.	327440.	561713.	
44	62	59845.	14655.	4.1	49980.	10369.	31570.	41940.	1.1622	356261.	512383.	0.590	213099.	573003.	403762.	577597.	
45	62	59845.	14664.	4.1	51560.	10682.	32619.	43301.	1.1650	365928.	529743.	0.591	219708.	590496.	416574.	577834.	
46	62	59845.	14674.	4.1	53194.	11010.	33695.	44705.	1.1677	375782.	547741.	0.593	226300.	608561.	429800.	578051.	
47	62	59845.	13810.	4.3	51425.	11359.	34782.	46141.	1.1701	385517.	569843.	0.596	233088.	662787.	405843.	568926.	
48	62	59845.	12959.	4.6	49565.	11699.	35912.	47611.	1.1722	395667.	596382.	0.601	240081.	721498.	381775.	558966.	
49	62	59845.	14852.	4.0	58905.	12033.	37096.	49129.	1.1744	406354.	616424.	0.603	247283.	667482.	481121.	577155.	
50	62	59845.	14878.	4.0	60777.	12396.	36918.	49314.	1.1445	418459.	635782.	0.604	254701.	687409.	496314.	577484.	

SIMULATION IVB*

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDED	PAY	PVFB	PVF	
AGE						COST	COST	COST	COST	PAY	PAST SVC	FNDED	RATIO		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8006.	10124.	1.0000	129269.	9297.	0.067	59845.	141927.	8271.	592170.	
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.	
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	22686.	592170.	
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.	
5	65	56754.	3916.	14.5	4340.	2439.	9734.	12173.	1.0431	148106.	47703.	0.244	48984.	171084.	40914.	558941.	
6	65	53828.	4626.	11.6	5335.	2429.	10258.	12687.	1.0916	153748.	57440.	0.272	68700.	178063.	49567.	527296.	
7	65	59845.	5308.	11.3	6432.	2836.	10852.	13687.	1.0088	160247.	67567.	0.297	80197.	189708.	58884.	591640.	
8	65	59845.	5960.	10.0	7590.	2977.	11496.	14473.	1.0160	167262.	77828.	0.318	84207.	199173.	68473.	591721.	
9	65	59845.	6582.	9.1	8809.	3126.	12192.	15119.	1.0241	174797.	88229.	0.335	88417.	209108.	78323.	591779.	
10	65	56748.	7171.	7.9	10087.	3113.	12943.	16056.	1.0781	182855.	98609.	0.350	88035.	217710.	88422.	558531.	
11	64	52975.	8570.	6.2	12676.	3385.	15009.	18393.	1.2600	211750.	109257.	0.340	86289.	236186.	111813.	511968.	
12	64	59845.	9091.	6.6	14135.	4018.	15933.	19950.	1.1521	221487.	120535.	0.352	102353.	252437.	123060.	585260.	
13	64	59845.	9576.	6.2	15653.	4221.	16920.	21141.	1.1628	231765.	132050.	0.363	107471.	265056.	134565.	585414.	
14	64	59845.	10025.	6.0	17228.	4435.	17973.	22407.	1.1737	242583.	143831.	0.372	112864.	278298.	146327.	585540.	
15	64	56701.	10437.	5.4	18859.	4415.	19094.	23508.	1.2378	253936.	155673.	0.380	112263.	289588.	158347.	551980.	
16	64	53727.	10811.	5.0	20542.	4395.	20285.	24680.	1.3061	265805.	167593.	0.387	111693.	301172.	170631.	520043.	
17	64	59845.	11148.	5.4	22277.	5141.	21547.	26687.	1.2076	278172.	180383.	0.393	130631.	321235.	183191.	585347.	
18	64	59845.	11448.	5.2	24061.	9400.	22885.	28284.	1.2189	291053.	193625.	0.399	137163.	337243.	196043.	585534.	
19	64	59845.	11713.	5.1	25895.	5671.	24301.	29973.	1.2302	304400.	207384.	0.405	144021.	354046.	209209.	585707.	
20	63	55837.	12804.	4.4	29777.	6149.	27775.	33924.	1.4212	350213.	221901.	0.388	141095.	382807.	244302.	537308.	
21	63	52859.	13003.	4.1	31812.	6120.	29451.	35570.	1.4992	365611.	236755.	0.393	140248.	397800.	259298.	505620.	
22	63	59845.	13173.	4.5	33904.	7275.	31217.	38492.	1.3647	381454.	253180.	0.399	166721.	425774.	274761.	579638.	
23	63	59845.	13320.	4.5	36065.	7844.	33081.	40724.	1.3751	397854.	270498.	0.405	175057.	445782.	293073.	579922.	
24	63	59845.	13440.	4.5	38283.	8030.	34076.	43076.	1.3852	414718.	288815.	0.411	183810.	469327.	327266.	580178.	
25	63	56651.	13538.	4.2	40572.	7990.	37115.	45105.	1.4593	432066.	307788.	0.416	182701.	487969.	324450.	546350.	
26	63	53630.	13617.	3.9	42937.	7950.	39294.	47243.	1.5377	449862.	327484.	0.421	181605.	507075.	342210.	514183.	
27	63	59845.	13681.	4.4	45384.	9309.	41584.	50893.	1.4138	468070.	349368.	0.427	212782.	514478.	360373.	580419.	
28	63	59845.	13731.	4.4	47920.	9778.	43995.	53773.	1.4227	486721.	372689.	0.434	223421.	568404.	380045.	580763.	
29	62	59845.	14645.	4.1	53746.	11328.	49608.	60937.	1.5354	555464.	398513.	0.418	234592.	619899.	435662.	575101.	
30	62	59845.	14674.	4.1	56651.	11904.	52424.	64328.	1.5437	565999.	426116.	0.425	246321.	650978.	458533.	575508.	
31	62	59845.	14696.	4.1	59679.	12507.	47378.	59885.	1.3686	598192.	447627.	0.428	258637.	683513.	482462.	575924.	
32	62	59845.	14713.	4.1	62840.	13140.	50092.	63232.	1.3763	628635.	470400.	0.428	271569.	717670.	507520.	576344.	
33	62	59845.	14724.	4.1	66144.	13804.	52948.	66752.	1.3838	660344.	494528.	0.428	285147.	735328.	533777.	576765.	
34	62	59845.	14732.	4.1	69600.	14501.	55951.	70452.	1.3909	693361.	520106.	0.429	299404.	791173.	561306.	577192.	
35	62	59845.	14738.	4.1	73220.	15233.	59109.	74341.	1.3978	727732.	547232.	0.429	314374.	830695.	590177.	577633.	
36	62	59845.	14741.	4.1	77013.	16000.	62392.	78392.	1.4038	763503.	575972.	0.430	330092.	872187.	620469.	578088.	
37	62	59845.	14746.	4.1	80990.	16806.	65800.	82606.	1.4088	800763.	606387.	0.431	346596.	915743.	652261.	578541.	
38	62	59845.	14745.	4.1	85161.	17652.	69363.	87014.	1.4133	839611.	638559.	0.432	363926.	961461.	685630.	578982.	
39	62	59845.	14746.	4.1	89539.	18539.	73088.	91627.	1.4174	880127.	672574.	0.433	382122.	1009488.	720661.	579414.	
40	62	59845.	14746.	4.1	94133.	19471.	76984.	96455.	1.4210	922399.	708523.	0.434	401227.	1059199.	757440.	579848.	
41	62	59845.	14747.	4.1	98957.	20449.	79802.	100251.	1.4206	964518.	745243.	0.435	421288.	1112693.	796057.	580286.	
42	62	59845.	13872.	4.3	97557.	21480.	84011.	105691.	1.4097	1013896.	790439.	0.438	442352.	1235576.	765922.	571412.	
43	62	59845.	13012.	4.6	95907.	22552.	88458.	111010.	1.4128	1064088.	845063.	0.443	444649.	1373355.	734372.	561713.	
44	62	59845.	14655.	4.1	114269.	23652.	93178.	116830.	1.4160	1117596.	889876.	0.443	487492.	1310064.	923127.	575797.	
45	62	59845.	14664.	4.1	120170.	24836.	98089.	122926.	1.4190	1173005.	937125.	0.444	512076.	1376274.	970911.	577834.	
46	62	59845.	14674.	4.1	126386.	26096.	103243.	129338.	1.4219	1231065.	986932.	0.445	537680.	1445920.	1021189.	578051.	
47	62	59845.	13810.	4.3	124556.	27441.	108607.	136048.	1.4244	1291172.	1047771.	0.448	564563.	1605336.	982992.	568926.	
48	62	59845.	12959.	4.6	122382.	28809.	114282.	143090.	1.4268	1354883.	1120867.	0.453	592791.	1781472.	942653.	558696.	
49	62	59845.	14852.	4.0	148268.	30208.	120315.	150523.	1.4295	1422873.	1179165.	0.453	622429.	1680102.	1211018.	577155.	
50	62	59845.	14878.	4.0	155950.	31723.	124613.	156336.	1.4310	1493133.	1238508.	0.453	653550.	1763856.	1273517.	577484.	

SIMULATION VA*

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDSD	PAY	PVFB	PVFB	PVF
AGE						COST	COST		COST	PAY	PAST SVC	FNDSD	RATIO		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10126.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.	
2	65	59845.	1634.	36.6	1639.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.	
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.	
4	65	59845.	3140.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.	
5	65	56754.	3916.	14.5	4166.	2259.	9013.	11272.	1.0431	136727.	45770.	0.251	63877.	158417.	39218.	558941.	
6	65	53828.	4626.	11.6	5000.	2206.	9283.	11490.	1.0884	138460.	54548.	0.283	62401.	161739.	46394.	527296.	
7	65	59845.	5308.	11.3	5832.	2527.	9561.	12088.	0.9999	140118.	63531.	0.312	71457.	169034.	53339.	591960.	
8	65	59845.	5960.	10.0	6660.	2602.	9848.	12450.	0.9999	141710.	72497.	0.338	73601.	174087.	60062.	591721.	
9	65	59845.	6582.	9.1	7553.	2681.	10180.	12860.	1.0028	143815.	81429.	0.362	75809.	179290.	67154.	591721.	
10	65	56748.	7171.	7.9	8484.	2618.	10545.	13163.	1.0508	146209.	90180.	0.381	74043.	183109.	74669.	558531.	
11	64	52975.	8570.	6.2	10471.	2793.	11977.	14769.	1.2263	165559.	98987.	0.374	71193.	194865.	92370.	511968.	
12	64	59845.	9091.	6.6	11440.	3252.	12404.	15656.	1.1172	168166.	108153.	0.391	82838.	204306.	99596.	582620.	
13	64	59845.	9576.	6.2	12427.	3351.	12861.	16212.	1.1232	170921.	117346.	0.407	85323.	210431.	106833.	585414.	
14	63	59845.	10885.	5.5	14570.	3821.	14485.	18306.	1.2313	192179.	126949.	0.398	87883.	226005.	126381.	579406.	
15	63	56655.	11297.	5.0	15597.	3731.	15018.	18748.	1.2932	195174.	136448.	0.411	85695.	230605.	133781.	545539.	
16	63	53639.	11671.	4.6	16621.	3643.	15573.	19216.	1.3592	198131.	145865.	0.424	83566.	235166.	141096.	513328.	
17	62	59845.	12882.	4.6	18928.	4621.	17411.	22031.	1.3561	221346.	156262.	0.414	86032.	256168.	152592.	573217.	
18	62	59845.	13182.	4.5	19983.	4765.	18088.	22813.	1.3633	224408.	166905.	0.427	98913.	263966.	170178.	573473.	
19	62	59845.	13467.	4.5	21031.	4913.	18710.	23623.	1.3706	227362.	177842.	0.439	101880.	272005.	177710.	573702.	
20	61	55721.	14567.	3.8	23506.	5195.	20783.	25978.	1.5116	252559.	189206.	0.428	97705.	286590.	201565.	524118.	
21	61	52661.	14766.	3.6	24586.	5067.	21534.	26601.	1.4532	255484.	200681.	0.440	95110.	291916.	209552.	491816.	
22	61	59845.	14936.	4.0	25663.	5930.	22311.	28241.	1.4995	258189.	213292.	0.452	111327.	307596.	217556.	567697.	
23	60	59845.	15984.	3.7	28335.	6714.	24634.	31348.	1.6160	285165.	226970.	0.443	114666.	327858.	244291.	561792.	
24	60	59845.	16104.	3.7	29458.	6924.	25510.	32434.	1.6233	287692.	241294.	0.456	118106.	338066.	252974.	562078.	
25	60	52519.	16202.	3.5	30584.	6748.	26416.	33164.	1.7063	289920.	255939.	0.469	114889.	344481.	261757.	527344.	
26	59	52460.	17195.	3.1	33485.	7085.	29019.	36104.	1.9430	318689.	271355.	0.460	109838.	360138.	291963.	478912.	
27	59	59845.	17259.	3.5	34680.	8318.	30033.	38350.	1.7565	320515.	288593.	0.474	129058.	381061.	301682.	556193.	
28	59	59845.	17309.	3.5	35889.	8576.	31081.	39657.	1.7635	321926.	306790.	0.488	132929.	393110.	311590.	556518.	
29	58	59845.	18273.	3.3	39078.	9677.	34000.	43677.	1.8856	352508.	326728.	0.481	136917.	417722.	345928.	550504.	
30	58	59845.	18303.	3.3	40384.	9976.	35172.	45148.	1.8924	353349.	347828.	0.496	141024.	431193.	357033.	550787.	
31	58	59845.	18325.	3.3	41715.	10283.	38376.	38659.	1.5732	353641.	362162.	0.506	145255.	445138.	368409.	551051.	
32	58	59845.	18341.	3.3	43074.	10599.	39388.	39987.	1.5799	361746.	377184.	0.510	149612.	459578.	380080.	551292.	
33	58	59845.	18353.	3.3	44463.	10925.	30435.	41360.	1.5865	369875.	392939.	0.515	154101.	474533.	392062.	551507.	
34	58	59845.	18361.	3.3	45886.	11259.	31519.	42778.	1.5931	378016.	409477.	0.520	158724.	490026.	404372.	551701.	
35	58	59845.	18366.	3.3	47345.	11603.	32640.	44243.	1.5997	386153.	426849.	0.525	163485.	506081.	417027.	551879.	
36	58	59845.	18370.	3.3	48843.	11957.	33800.	45757.	1.6062	394272.	445105.	0.530	168389.	522723.	430041.	552037.	
37	58	59845.	18372.	3.3	50382.	12322.	35000.	47322.	1.6128	402357.	464300.	0.536	173441.	539973.	443430.	552156.	
38	58	59845.	17448.	3.4	49201.	12701.	36242.	48943.	1.6194	410391.	487256.	0.543	178644.	589321.	423741.	542593.	
39	58	59845.	16536.	3.6	47949.	13090.	37504.	50594.	1.6253	418589.	514263.	0.551	184003.	642754.	403841.	532100.	
40	58	59845.	18266.	3.3	46958.	13473.	38807.	52280.	1.6306	427060.	537298.	0.557	189523.	605678.	484741.	548037.	
41	58	59845.	18273.	3.3	56692.	13878.	39083.	52961.	1.6037	435227.	560431.	0.563	195209.	626345.	500070.	547765.	
42	58	59845.	18279.	3.3	58478.	14298.	40422.	54720.	1.6087	444469.	584694.	0.568	201065.	647850.	515861.	547408.	
43	58	59845.	17359.	3.4	57109.	14736.	41793.	56530.	1.6135	453760.	613349.	0.575	207097.	706769.	493228.	537312.	
44	58	59845.	16450.	3.6	55658.	15185.	42077.	57262.	1.5868	463358.	645620.	0.582	213309.	770560.	470348.	526257.	
45	58	59845.	18443.	3.2	64728.	15625.	43541.	59165.	1.5918	474572.	672338.	0.586	219708.	817851.	457244.	544274.	
46	58	59845.	18468.	3.2	66822.	16099.	45030.	61129.	1.5967	485859.	700262.	0.591	226300.	874350.	594325.	543785.	
47	58	59845.	18753.	3.2	69934.	16598.	45284.	61882.	1.5693	496342.	727222.	0.594	233088.	952529.	545866.	545866.	
48	58	59845.	17834.	3.4	68334.	17107.	46805.	63911.	1.5736	508433.	759160.	0.599	240081.	826584.	598553.	535664.	
49	58	59845.	16926.	3.5	66637.	17629.	48390.	66019.	1.5781	520975.	796499.	0.605	247283.	901110.	571485.	524475.	
50	58	59845.	19005.	3.1	77507.	18139.	48663.	68002.	1.5503	534107.	826619.	0.607	254701.	837539.	697555.	543260.	

SIMULATION VB*

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL COST	PAST COST	SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS ENDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVFB SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.	592170.
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.
5	65	56754.	3916.	14.5	4340.	2439.	9734.	12173.	1.0431	148106.	47703.	0.244	68984.	171084.	40914.	558941.
6	65	53828.	4626.	11.6	5335.	2429.	10258.	12687.	1.0916	153748.	57440.	0.272	68700.	178063.	49567.	527296.
7	65	59845.	5308.	11.3	6437.	2836.	10852.	13687.	1.0088	160247.	67567.	0.297	80197.	189708.	58884.	591640.
8	65	59845.	5960.	10.0	7590.	2977.	11496.	14473.	1.0160	167262.	77828.	0.318	84207.	199173.	68473.	591721.
9	65	59845.	6582.	9.1	8809.	3126.	12192.	15319.	1.0241	174797.	88229.	0.335	88417.	209108.	78323.	591779.
10	65	56748.	7171.	7.9	10087.	3113.	12943.	16056.	1.0781	182855.	98609.	0.350	88035.	217710.	88422.	558531.
11	64	52975.	8570.	6.2	12676.	3385.	15009.	18393.	1.2680	211750.	109257.	0.340	86289.	236186.	111813.	511968.
12	64	59845.	9091.	6.6	14135.	4018.	15933.	19950.	1.1521	221487.	120535.	0.352	102353.	252437.	123060.	585260.
13	64	59845.	9576.	6.2	15653.	4221.	16920.	21141.	1.1628	231765.	132050.	0.363	107471.	265054.	134565.	585414.
14	63	59845.	10885.	5.5	18709.	4906.	19443.	24349.	1.2755	266325.	144293.	0.351	112844.	290198.	162277.	579406.
15	63	56655.	11297.	5.0	20416.	4883.	20635.	25517.	1.3447	278456.	156609.	0.360	112172.	301854.	175123.	545539.
16	63	53639.	11671.	4.6	22179.	4860.	21900.	26760.	1.4185	291130.	169020.	0.367	111509.	313801.	189276.	513328.
17	62	59845.	12882.	4.6	25747.	6284.	24953.	31237.	1.4135	331976.	182960.	0.357	131031.	338463.	221173.	573217.
18	62	59845.	13182.	4.5	27710.	6605.	26456.	33061.	1.4248	346624.	197460.	0.363	137163.	356043.	235987.	573473.
19	62	59845.	13447.	4.5	29730.	6953.	28046.	34989.	1.4360	361840.	212591.	0.370	144021.	384514.	251216.	573702.
20	61	55721.	14567.	3.8	33876.	7482.	31725.	39207.	1.6460	409873.	228553.	0.358	140081.	412999.	290471.	524118.
21	61	52641.	14766.	3.6	36119.	7438.	33595.	41033.	1.7359	427242.	244895.	0.364	139722.	428843.	307845.	491816.
22	61	59845.	14936.	4.0	38433.	8874.	35566.	44440.	1.5756	445145.	263147.	0.372	166721.	460652.	325809.	567697.
23	60	59845.	15984.	3.7	43258.	10242.	39963.	50205.	1.6953	501030.	283252.	0.361	175057.	500529.	372951.	561792.
24	60	59845.	16104.	3.7	45845.	10766.	42268.	53033.	1.7055	521313.	304602.	0.369	183810.	526135.	393705.	560278.
25	60	56519.	16202.	3.5	48522.	10693.	44697.	55390.	1.7963	542206.	326701.	0.376	182274.	546529.	415284.	527344.
26	59	52460.	17195.	3.1	54156.	11444.	49949.	61393.	2.0428	607159.	350273.	0.366	177645.	582465.	472203.	478912.
27	59	59845.	17259.	3.5	57178.	13697.	52769.	66466.	1.8464	630579.	377073.	0.374	212782.	662820.	497395.	565193.
28	59	59845.	17309.	3.5	60320.	14394.	55739.	70163.	1.8555	656460.	405740.	0.383	223421.	666072.	523705.	556518.
29	58	59845.	18273.	3.3	66956.	16557.	62012.	78568.	1.9797	730102.	437639.	0.375	234592.	715721.	592710.	550504.
30	58	59845.	18303.	3.3	70537.	17397.	65458.	82856.	1.9883	757120.	471838.	0.384	246321.	753147.	623613.	550787.
31	58	59845.	18325.	3.3	74277.	18279.	61800.	79359.	1.8137	784835.	500512.	0.389	258673.	792603.	655980.	551051.
32	58	59845.	18341.	3.3	78185.	19205.	64503.	83707.	1.8220	821650.	531060.	0.393	271569.	834203.	689901.	551292.
33	58	59845.	18353.	3.3	82274.	20176.	68109.	88284.	1.8301	859996.	563622.	0.396	285147.	878073.	725469.	551507.
34	58	59845.	18361.	3.3	86556.	21195.	71908.	93102.	1.8381	899930.	598349.	0.399	299404.	924380.	762776.	551701.
35	58	59845.	18366.	3.3	91043.	22264.	75910.	98174.	1.8459	941511.	635399.	0.403	314374.	973169.	801922.	551879.
36	58	59845.	18370.	3.3	95747.	23386.	80090.	103476.	1.8530	984802.	674896.	0.407	330092.	1026680.	843053.	552037.
37	58	59845.	18372.	3.3	100681.	24564.	84451.	109014.	1.8592	1029191.	716874.	0.410	346596.	1079057.	884330.	552156.
38	58	59845.	17448.	3.4	100231.	25807.	89024.	114682.	1.8652	1076593.	767423.	0.414	363926.	1200538.	883225.	542593.
39	58	59845.	16536.	3.6	99576.	27110.	93861.	120971.	1.8713	1126635.	827188.	0.423	381222.	1334813.	862611.	532100.
40	58	59845.	18266.	3.3	116348.	28465.	98996.	127441.	1.8775	1179416.	879640.	0.427	401227.	1282440.	1062313.	548037.
41	58	59845.	18273.	3.3	122349.	29865.	103097.	129631.	1.8656	1233977.	934235.	0.431	412288.	1351743.	1079223.	547765.
42	58	59845.	18279.	3.3	128655.	31366.	108675.	140041.	1.8713	1292366.	992332.	0.434	442352.	1425301.	1134918.	547408.
43	58	59845.	17359.	3.4	128081.	32950.	114543.	147493.	1.8771	1353528.	1061359.	0.440	464469.	1585118.	1106195.	537312.
44	58	59845.	16450.	3.6	127251.	34608.	119293.	153902.	1.8654	1418344.	1141077.	0.446	487692.	1761742.	1075362.	526257.
45	58	59845.	18443.	3.2	150862.	36303.	136303.	162148.	1.8717	1488976.	1209415.	0.448	512076.	1675431.	1341845.	544274.
46	58	59845.	18468.	3.2	158766.	38129.	132695.	170824.	1.8780	1562277.	1281943.	0.451	537680.	1766531.	1412095.	543785.
47	58	59845.	18753.	3.2	169388.	40072.	138140.	178213.	1.8659	1638237.	1354804.	0.453	564556.	1835532.	1514465.	543886.
48	58	59845.	17834.	3.4	168725.	42098.	145580.	187677.	1.8714	1719428.	1441559.	0.456	592791.	2040943.	1477905.	536664.
49	58	59845.	16926.	3.5	167731.	44221.	153463.	197684.	1.8774	1805450.	1543389.	0.461	622429.	2268816.	1438470.	524475.
50	58	59845.	16905.	3.1	198880.	46384.	159853.	202420.	1.8653	1897119.	1628126.	0.462	653550.	2419082.	1789890.	543260.

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD $F = 0.80$

T	RET AGE	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE	
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.	45893.	0.251	67355.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.	54924.	0.284	69376.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.	63927.	0.313	71457.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.	72915.	0.340	73601.	174551.	60062.	592170.
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	1.0030	143857.	81870.	0.363	75809.	179787.	67154.	592170.
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	1.0075	146266.	90789.	0.383	78083.	185181.	74369.	592170.
11	65	59845.	7726.	7.7	9426.	2844.	10935.	13779.	1.0127	148750.	99682.	0.401	80425.	190748.	81481.	592170.
12	65	59845.	8247.	7.3	10375.	2929.	11343.	14272.	1.0184	151291.	108544.	0.418	82830.	196438.	88483.	592170.
13	65	59845.	8732.	6.9	11329.	3017.	11773.	14760.	1.0246	153872.	117452.	0.433	85233.	202351.	95366.	592170.
14	65	59845.	9181.	6.5	12285.	3108.	12223.	15300.	1.0311	156473.	126371.	0.447	87683.	208422.	102125.	592170.
15	65	59845.	9593.	6.2	13239.	3201.	12694.	15895.	1.0380	159074.	135345.	0.460	90159.	214674.	108761.	592170.
16	65	59845.	9967.	6.0	14190.	3297.	13187.	16484.	1.0451	161655.	144406.	0.472	92353.	221114.	115275.	592170.
17	65	59845.	10304.	5.8	15134.	3396.	13702.	17097.	1.0524	164492.	153589.	0.483	96032.	227747.	121672.	592170.
18	65	59845.	10604.	5.6	16070.	3498.	14238.	17735.	1.0599	166664.	162933.	0.494	98913.	234580.	127962.	592170.
19	65	59845.	10869.	5.5	16996.	3603.	14795.	18398.	1.0674	169047.	172481.	0.505	101880.	241617.	134158.	592170.
20	65	59845.	11100.	5.4	17912.	3711.	15375.	19085.	1.0751	171317.	182278.	0.515	104936.	248865.	140274.	592170.
21	65	58348.	11299.	5.2	18818.	3726.	15976.	19742.	1.1051	173448.	192277.	0.526	105382.	255304.	146328.	576084.
22	65	58552.	11470.	5.0	19713.	3740.	16600.	20340.	1.1368	175413.	202517.	0.536	105760.	261795.	152340.	559907.
23	65	55356.	11616.	4.8	20605.	3751.	17246.	20996.	1.1701	177180.	213033.	0.546	106066.	268330.	158328.	543653.
24	65	53860.	11736.	4.6	21486.	3759.	17914.	21673.	1.2052	178781.	223872.	0.556	106296.	274895.	164310.	527332.
25	65	52364.	11834.	4.4	22362.	3764.	18605.	22369.	1.2422	179995.	235072.	0.566	106443.	281477.	170311.	510951.
26	65	50868.	11914.	4.3	23236.	3766.	19318.	23085.	1.2812	180976.	246673.	0.577	106504.	288062.	176352.	494516.
27	65	49372.	11977.	4.1	24111.	3765.	20055.	23820.	1.3224	181624.	258715.	0.588	106472.	294632.	182454.	478031.
28	65	47876.	12027.	4.0	24989.	3761.	20814.	24574.	1.3660	181902.	271236.	0.599	106343.	301168.	188636.	461499.
29	65	46380.	12066.	3.8	25873.	3752.	21596.	25349.	1.4121	181770.	284273.	0.610	106111.	307648.	194918.	444924.
30	65	44883.	12096.	3.7	26767.	3740.	22402.	26142.	1.4610	181186.	297862.	0.622	105768.	314058.	201316.	428309.
31	65	44883.	12118.	3.7	27672.	3893.	15222.	19075.	1.0359	181092.	304157.	0.628	105944.	321727.	207846.	427747.
32	65	44883.	12136.	3.7	28593.	3968.	15835.	19835.	1.0432	186886.	310575.	0.624	112209.	329500.	214524.	427250.
33	65	44883.	12146.	3.7	29530.	4087.	16464.	20551.	1.0511	193755.	317125.	0.621	115575.	337362.	221364.	426813.
34	65	44883.	12156.	3.7	30489.	4210.	17110.	21220.	1.0587	200702.	323813.	0.617	119043.	345302.	228378.	426433.
35	65	44883.	12159.	3.7	31467.	4336.	17774.	22100.	1.0659	207718.	330446.	0.614	122614.	353310.	235578.	426115.
36	65	44883.	12163.	3.7	32471.	4466.	18455.	22921.	1.0728	214794.	337628.	0.611	126292.	361375.	242974.	425864.
37	65	44883.	12165.	3.7	33501.	4600.	19153.	23753.	1.0794	221922.	344762.	0.608	130081.	369484.	250577.	425686.
38	65	44883.	12167.	3.7	34558.	4738.	19868.	24607.	1.0856	229091.	352048.	0.606	133983.	377624.	258395.	425588.
39	65	44883.	12167.	3.7	35644.	4880.	20564.	25445.	1.0899	236289.	359451.	0.603	138002.	385777.	266438.	425573.
40	65	44883.	12168.	3.7	36761.	5027.	21253.	26280.	1.0929	243544.	366942.	0.601	142142.	393926.	274133.	425648.
41	65	44883.	12168.	3.7	37910.	5178.	21948.	27126.	1.0952	250869.	374505.	0.599	146407.	402050.	282230.	425815.
42	65	44883.	12168.	3.7	39093.	5333.	22649.	27983.	1.0969	258267.	382119.	0.597	150799.	410129.	291996.	426081.
43	65	44883.	12168.	3.7	40310.	5493.	23357.	28850.	1.0979	265738.	389765.	0.595	155322.	418136.	301020.	426453.
44	65	44883.	12168.	3.7	41562.	5658.	24070.	29728.	1.0984	273282.	397419.	0.593	159982.	426045.	310309.	426941.
45	65	44883.	12168.	3.7	42851.	5828.	24789.	30617.	1.0983	280897.	405055.	0.591	164781.	433828.	317873.	427599.
46	65	44883.	12168.	3.7	44178.	6003.	25515.	31517.	1.0977	288583.	412647.	0.588	169725.	441453.	329720.	428326.
47	65	44883.	12168.	3.7	45504.	6183.	26231.	32414.	1.0960	296087.	420189.	0.587	174816.	448885.	339611.	429262.
48	65	44883.	12168.	3.7	46869.	6368.	26952.	33320.	1.0938	303623.	427650.	0.585	180061.	456087.	349799.	430387.
49	65	44883.	12168.	3.7	48275.	6559.	27675.	34235.	1.0911	311186.	434992.	0.583	185462.	463017.	360292.	431719.
50	65	44883.	12168.	3.7	49723.	6756.	28402.	35158.	1.0879	318769.	442176.	0.581	191026.	469627.	371101.	433273.

SIMULATION IB**

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T RET AGE	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL COST	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNOED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1 65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	827.1
2 65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	1650.1
3 65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.
4 65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.
5 65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.
6 65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57851.	0.273	76378.	181137.	49567.
7 65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160175.	68001.	0.298	80197.	190194.	58884.
8 65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.
9 65	59845.	6582.	9.1	8809.	3126.	12197.	15244.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.
10 65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.
11 65	59845.	7726.	7.7	11424.	3447.	13759.	17206.	1.0433	191574.	110043.	0.365	97480.	231181.	98759.
12 65	59845.	8247.	7.3	12819.	3619.	14627.	18246.	1.0537	200711.	120972.	0.376	102353.	242740.	109328.
13 65	59845.	8732.	6.9	14269.	3800.	15555.	19355.	1.0646	210374.	132106.	0.386	107471.	254877.	120120.
14 65	59845.	9181.	6.5	15774.	3990.	16547.	20547.	1.0758	220575.	143474.	0.394	112844.	267620.	131132.
15 65	59845.	9593.	6.2	17330.	4190.	17603.	21792.	1.0872	231261.	155110.	0.401	118487.	281001.	142346.
16 65	59845.	9967.	6.0	18935.	4399.	18726.	23125.	1.0987	242476.	167056.	0.408	124411.	295051.	153820.
17 65	59845.	10304.	5.8	20587.	4619.	19920.	24539.	1.1104	254198.	179360.	0.414	130631.	309803.	165509.
18 65	59845.	10604.	5.6	22285.	4850.	21185.	26035.	1.1220	266420.	192078.	0.419	137163.	325293.	174746.
19 65	59845.	10869.	5.5	24027.	5092.	22526.	27618.	1.1335	279135.	205273.	0.424	144021.	341557.	189650.
20 65	59845.	11109.	5.4	25813.	5347.	23944.	29291.	1.1450	292334.	219015.	0.428	151221.	358635.	202146.
21 65	58348.	11299.	5.2	27644.	5474.	25443.	30918.	1.1805	306010.	233239.	0.433	154813.	373057.	214965.
22 65	56852.	11470.	5.0	29522.	5600.	27027.	32627.	1.2177	320146.	248006.	0.437	158385.	392061.	228142.
23 65	55356.	11616.	4.8	31458.	5726.	28696.	34422.	1.2565	334726.	263370.	0.440	161928.	409649.	241714.
24 65	53860.	11736.	4.6	33439.	5850.	30456.	36305.	1.2972	349729.	279404.	0.444	165429.	427821.	255717.
25 65	52364.	11834.	4.4	35479.	5971.	32308.	38279.	1.3399	365134.	296175.	0.448	168875.	446572.	270204.
26 65	50868.	11914.	4.3	37581.	6091.	34256.	40347.	1.3846	380918.	313750.	0.452	172252.	465893.	285221.
27 65	49372.	11977.	4.1	39753.	6207.	36304.	42512.	1.4315	397053.	332196.	0.456	175545.	485771.	300820.
28 65	47876.	12027.	4.0	42000.	6320.	38456.	44776.	1.4808	413510.	351581.	0.460	178737.	506188.	317051.
29 65	46380.	12066.	3.8	44331.	6429.	40714.	47143.	1.5327	430258.	371972.	0.464	181809.	527121.	333970.
30 65	44883.	12096.	3.7	46752.	6533.	43083.	49616.	1.5875	447258.	393433.	0.468	184741.	548537.	351629.
31 65	44883.	12119.	3.7	49273.	6859.	37558.	44418.	1.3535	464470.	408250.	0.468	193978.	572858.	373085.
32 65	44883.	12134.	3.7	51900.	7202.	39761.	46963.	1.3629	490266.	423724.	0.466	203676.	598002.	389393.
33 65	44883.	12146.	3.7	54643.	7562.	42067.	49629.	1.3717	517040.	439897.	0.460	213860.	624952.	409411.
34 65	44883.	12154.	3.7	57510.	7940.	44481.	52421.	1.3799	544814.	458802.	0.456	224555.	651351.	430795.
35 65	44883.	12159.	3.7	60510.	8337.	47007.	55345.	1.3785	573607.	478476.	0.453	235780.	679398.	453005.
36 65	44883.	12163.	3.7	63653.	8754.	49612.	58366.	1.3936	603437.	492913.	0.450	247569.	708399.	476300.
37 65	44883.	12165.	3.7	66946.	9192.	52291.	61483.	1.3981	634363.	512096.	0.447	259947.	738360.	500741.
38 65	44883.	12167.	3.7	70400.	9652.	55070.	64722.	1.4017	666452.	532022.	0.444	272944.	769278.	526391.
39 65	44883.	12167.	3.7	74023.	10134.	57953.	68087.	1.4043	699749.	552687.	0.441	286591.	801147.	553316.
40 65	44883.	12168.	3.7	77825.	10641.	60943.	71584.	1.4061	734299.	574079.	0.439	300920.	833955.	581577.
41 65	44883.	12168.	3.7	81816.	11173.	64045.	75218.	1.4072	770150.	596184.	0.436	315966.	867682.	611250.
42 65	44883.	12168.	3.7	86006.	11732.	67262.	78933.	1.4074	807345.	618981.	0.434	331764.	902303.	642405.
43 65	44883.	12168.	3.7	90405.	12318.	70598.	82917.	1.4070	845929.	642441.	0.432	348352.	937781.	675116.
44 65	44883.	12168.	3.7	95024.	12934.	74058.	86992.	1.4059	885942.	666532.	0.429	365769.	974073.	709464.
45 65	44883.	12168.	3.7	99873.	13581.	77646.	91227.	1.4049	927429.	691211.	0.427	384057.	1011217.	745530.
46 65	44883.	12168.	3.7	104966.	14260.	81364.	95624.	1.4017	970425.	716429.	0.425	403260.	1048877.	783402.
47 65	44883.	12168.	3.7	110214.	14973.	85180.	100153.	1.3982	1014367.	742188.	0.423	423422.	1087246.	822571.
48 65	44883.	12168.	3.7	115725.	15722.	89127.	104849.	1.3940	1059786.	768421.	0.420	444593.	1126139.	863699.
49 65	44883.	12168.	3.7	121511.	16508.	93209.	109716.	1.3893	1106707.	795047.	0.418	466822.	1165448.	903883.
50 65	44883.	12168.	3.7	127586.	17333.	97426.	114759.	1.3839	1155145.	821278.	0.416	490163.	1205039.	952226.

SIMULATION IVA**

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDSD	PAY	PVFB	PVFB	PVF
AGE				RET		COST	COST	COST	COST	PAY	PAST		RATIO		ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8009.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.			592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	61640.	146184.			592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.			592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.			592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.	45893.	0.251	67355.	159739.			592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.	54924.	0.284	69376.	164531.			592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.	63927.	0.313	71457.	169467.			592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.	72915.	0.340	73601.	174551.			592170.
9	65	59845.	6582.	9.1	7553.	2681.	10182.	12863.	1.0030	143357.	81870.	0.363	75809.	179787.			592170.
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	1.0075	144266.	90789.	0.383	78033.	185181.			592170.
11	64	59845.	8570.	7.0	10471.	3155.	11986.	15141.	1.1128	165713.	99999.	0.376	80425.	199562.			586001.
12	64	59845.	9091.	6.6	11440.	3252.	12416.	15668.	1.1180	168355.	109227.	0.393	82838.	205600.			586051.
13	64	59845.	9576.	6.2	12427.	3351.	12875.	16227.	1.1242	171145.	118488.	0.409	85323.	211822.			586091.
14	64	59845.	10025.	6.0	13417.	3454.	13367.	16811.	1.1307	173952.	127806.	0.424	87883.	218235.			586125.
15	64	59845.	10437.	5.7	14407.	3560.	13850.	17420.	1.1376	176754.	137209.	0.437	90519.	224844.			586154.
16	64	59845.	10811.	5.5	15395.	3668.	14387.	18055.	1.1447	179530.	146729.	0.450	93235.	231656.			586180.
17	64	59845.	11148.	5.4	16377.	3780.	14935.	18715.	1.1520	182257.	156404.	0.462	96032.	238679.			586204.
18	64	59845.	11448.	5.2	17352.	3895.	15507.	19402.	1.1595	184912.	166274.	0.473	98913.	245917.			586226.
19	64	59845.	11713.	5.1	18318.	4013.	16101.	20114.	1.1670	187470.	176385.	0.485	101880.	253379.			586246.
20	63	59845.	12004.	4.7	20663.	4574.	18110.	22684.	1.2778	212366.	187225.	0.469	104936.	272369.			579994.
21	63	58348.	13003.	4.5	21654.	4598.	18790.	23388.	1.3119	214943.	198319.	0.480	105382.	279427.			564088.
22	63	58652.	13173.	4.3	22639.	4619.	19495.	24114.	1.3477	217337.	209710.	0.491	105760.	286631.			548090.
23	63	55356.	13320.	4.2	23623.	4637.	20225.	24862.	1.3855	219516.	221433.	0.502	106066.	293834.			532017.
24	63	53860.	13440.	4.0	24599.	4651.	20980.	25631.	1.4254	221445.	233537.	0.513	106296.	301068.			515880.
25	63	52364.	13538.	3.9	25573.	4662.	21761.	26423.	1.4673	223090.	246064.	0.524	106443.	308318.			499689.
26	63	50868.	13617.	3.7	26548.	4669.	22567.	27237.	1.5117	224412.	259056.	0.536	106590.	315567.			483450.
27	63	49372.	13681.	3.6	27526.	4672.	23400.	28072.	1.5585	225372.	272554.	0.547	106472.	322796.			467169.
28	63	47876.	13731.	3.5	28511.	4671.	24258.	28929.	1.6080	225926.	286600.	0.559	106343.	329982.			450848.
29	62	46380.	14645.	3.2	31368.	5144.	26961.	32105.	1.7885	255373.	301667.	0.542	106111.	334915.			428971.
30	62	44883.	14674.	3.1	32439.	5136.	27923.	33058.	1.8475	255360.	317374.	0.554	105768.	356821.			412760.
31	62	44883.	14696.	3.1	33517.	5295.	29094.	34200.	1.4216	254790.	325926.	0.561	108941.	365731.			270959.
32	62	44883.	14713.	3.1	34620.	5459.	30583.	35420.	1.4216	262025.	334745.	0.561	112209.	374771.			279603.
33	62	44883.	14724.	3.0	35746.	5628.	32484.	36811.	1.4377	269225.	343847.	0.561	115575.	383933.			288464.
34	62	44883.	14732.	3.0	36897.	5801.	33307.	39107.	1.4453	276524.	353249.	0.561	119043.	393207.			297565.
35	62	44883.	14738.	3.0	38077.	5979.	34152.	39131.	1.4526	283764.	362965.	0.561	122614.	402585.			306912.
36	62	44883.	14741.	3.0	39286.	6162.	35020.	31182.	1.4595	290973.	373009.	0.562	126292.	412055.			316519.
37	62	44883.	14744.	3.0	40528.	6350.	35912.	32262.	1.4660	298134.	383393.	0.563	130081.	421605.			326399.
38	62	44883.	14745.	3.0	41804.	6544.	36826.	33370.	1.4722	305231.	394129.	0.564	133983.	431233.			336563.
39	62	44883.	14746.	3.0	43116.	6744.	37727.	34471.	1.4765	312241.	405190.	0.565	138002.	440893.			347021.
40	62	44883.	14746.	3.0	44465.	6949.	38628.	35577.	1.4795	319184.	416561.	0.566	142142.	450598.			357784.
41	62	44883.	14747.	3.0	45853.	7160.	39490.	36649.	1.4833	326064.	427185.	0.567	146407.	460318.			368862.
42	62	44883.	14747.	3.0	47281.	7377.	40393.	36770.	1.4493	333974.	438033.	0.567	150799.	470031.			380267.
43	62	44883.	14747.	3.0	48752.	7601.	40301.	37902.	1.4424	341879.	449084.	0.568	155322.	479714.			392008.
44	62	44883.	14747.	3.0	50265.	7831.	41221.	39052.	1.4429	349779.	460325.	0.568	159982.	489340.			404096.
45	62	44883.	14747.	3.0	51824.	8067.	42154.	40221.	1.4428	357666.	471739.	0.569	164781.	498881.			416542.
46	62	44883.	14747.	3.0	53428.	8311.	43099.	41410.	1.4422	365532.	483307.	0.569	169725.	508308.			429358.
47	62	44883.	14747.	3.0	55031.	8562.	44037.	42599.	1.4404	373047.	495040.	0.570	174816.	517587.			442238.
48	62	44883.	14986.	3.0	57640.	8819.	34984.	43803.	1.4380	380480.	505956.	0.571	180061.	516693.			465981.
49	62	44883.	14994.	3.0	59401.	9087.	35937.	45024.	1.4350	387743.	516876.	0.571	185462.	524220.			480012.
50	62	44883.	15002.	3.0	61212.	9362.	35505.	44867.	1.3884	394857.	526374.	0.571	191026.	531364.			494423.

SIMULATION IVB**

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL COST	PAST COST	SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1636.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138343.	28271.	0.170	65979.	156474.	24686.	592170.
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.
5	65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.	592170.
6	65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57851.	0.273	76378.	181137.	49567.	592170.
7	65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160275.	68001.	0.298	80197.	190194.	58889.	592170.
8	65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.	592170.
9	65	59845.	6582.	9.1	8809.	3126.	12197.	15324.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.	592170.
10	65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.	592170.
11	64	59845.	8570.	7.0	12676.	3824.	15024.	18848.	1.1429	211991.	110433.	0.343	97480.	241879.	111813.	586002.
12	64	59845.	9091.	6.6	14135.	4018.	15952.	19970.	1.1533	221997.	121790.	0.354	102353.	254035.	130600.	586051.
13	64	59845.	9576.	6.2	15653.	4221.	16944.	21166.	1.1641	232152.	133392.	0.365	107471.	268605.	143565.	586091.
14	64	59845.	10025.	6.0	17228.	4435.	18003.	22438.	1.1753	243052.	145271.	0.374	112844.	280220.	156272.	586125.
15	64	59845.	10437.	5.7	18859.	4659.	19130.	23789.	1.1868	254495.	157465.	0.382	118487.	294313.	158347.	586154.
16	64	59845.	10811.	5.5	20542.	4894.	20328.	25222.	1.1984	266476.	170018.	0.390	124411.	309118.	170371.	586180.
17	64	59845.	11149.	5.4	22277.	5141.	21601.	26741.	1.2100	278990.	182983.	0.396	130631.	324672.	183191.	586204.
18	64	59845.	11448.	5.2	24061.	5400.	22950.	28349.	1.2217	292033.	196419.	0.402	137163.	341014.	196043.	586226.
19	64	59845.	11713.	5.1	25895.	5671.	24378.	30050.	1.2333	305595.	210395.	0.408	144021.	358184.	209209.	586246.
20	63	59845.	12804.	4.7	29777.	6589.	27895.	34483.	1.3479	352039.	225622.	0.391	151221.	392506.	243302.	579994.
21	63	58348.	13003.	4.5	31812.	6751.	29588.	36340.	1.3875	367688.	241431.	0.396	154813.	410562.	259298.	564088.
22	63	56852.	13173.	4.3	33906.	6913.	31377.	38290.	1.4290	383865.	257888.	0.402	158385.	429254.	274761.	548090.
23	63	55356.	13320.	4.2	36065.	7074.	33262.	40337.	1.4725	400553.	275053.	0.407	161928.	448586.	290773.	532017.
24	63	53860.	13440.	4.0	38283.	7233.	35242.	42483.	1.5180	417733.	293005.	0.412	165429.	468556.	307266.	515880.
25	63	52364.	13538.	3.9	40572.	7390.	37342.	44733.	1.5658	435384.	311816.	0.417	168875.	489156.	324405.	499689.
26	63	50868.	13617.	3.7	42937.	7544.	39544.	47088.	1.6159	453482.	331558.	0.422	172252.	510378.	342210.	483450.
27	63	49372.	13681.	3.6	45384.	7695.	41859.	49554.	1.6686	471998.	352306.	0.427	175545.	532206.	360737.	467169.
28	63	47876.	13731.	3.5	47920.	7841.	44291.	52132.	1.7361	490903.	374133.	0.433	178737.	554618.	380045.	450848.
29	62	46330.	14645.	3.2	53746.	8803.	49959.	58762.	1.9105	560433.	397856.	0.415	181809.	590927.	435662.	428971.
30	62	44883.	14676.	3.1	56651.	8957.	52788.	61745.	1.9756	581656.	422843.	0.421	184741.	632344.	458533.	412760.
31	62	44883.	14713.	3.1	59679.	9113.	55747.	64747.	1.9756	603193.	441466.	0.423	193978.	651211.	482562.	412614.
32	62	44883.	14729.	3.0	62840.	9892.	60546.	68348.	1.7514	633418.	461047.	0.421	203676.	680264.	507520.	412124.
33	62	44883.	14729.	3.0	66144.	10394.	63689.	71690.	1.7687	657129.	503315.	0.419	224553.	714716.	561306.	411693.
34	62	44883.	14732.	3.0	69600.	10920.	66934.	70856.	1.7764	730652.	526117.	0.419	235780.	774151.	591077.	411550.
35	62	44883.	14738.	3.0	73220.	11473.	70938.	74658.	1.7826	765308.	550068.	0.418	247569.	807746.	620469.	411461.
36	62	44883.	14741.	3.0	77013.	12052.	74658.	78155.	1.7872	801155.	575176.	0.418	259947.	842516.	652261.	411431.
37	62	44883.	14744.	3.0	80990.	12660.	78594.	82693.	1.7908	838253.	601465.	0.418	272944.	878469.	685630.	411467.
38	62	44883.	14745.	3.0	85161.	13298.	82693.	86960.	1.7936	876645.	628960.	0.418	286591.	915608.	720661.	411577.
39	62	44883.	14746.	3.0	89539.	13968.	86960.	91404.	1.7955	916372.	657678.	0.418	300920.	953931.	757440.	411765.
40	62	44883.	14746.	3.0	94133.	14671.	91404.	95767.	1.7729	957476.	686372.	0.418	315966.	993431.	796057.	412033.
41	62	44883.	14747.	3.0	98957.	15408.	95266.	99526.	1.7733	1001320.	716195.	0.417	331764.	1034090.	836605.	412385.
42	62	44883.	14747.	3.0	104021.	16183.	83344.	104481.	1.7729	1046746.	747147.	0.416	348352.	1075886.	879182.	412825.
43	62	44883.	14747.	3.0	109339.	16995.	87486.	109639.	1.7718	1093795.	779220.	0.416	365769.	1118794.	923890.	413364.
44	62	44883.	14747.	3.0	114922.	17848.	91791.	115008.	1.7701	1142512.	812403.	0.416	384057.	1162747.	970839.	414014.
45	62	44883.	14747.	3.0	120786.	18743.	96265.	120596.	1.7677	1192935.	846476.	0.415	403260.	1207721.	1020139.	414793.
46	62	44883.	14747.	3.0	126943.	19683.	100913.	126366.	1.7661	1249354.	882084.	0.415	423422.	1253647.	1071145.	415726.
47	62	44883.	14747.	3.0	133290.	20670.	105695.	132566.	1.7597	1297386.	916224.	0.414	444593.	1295783.	1110569.	419370.
48	62	44883.	14986.	3.0	142320.	21703.	110654.	138574.	1.7547	1351883.	951092.	0.413	466822.	1319500.	1208227.	421025.
49	62	44883.	14994.	3.0	149516.	22793.	115781.	143018.	1.7247	1407917.	984596.	0.412	490163.	1363452.	1268663.	422902.
50	62	44883.	15002.	3.0	157068.	23938.	119800.	143018.	1.7247	1407917.	984596.	0.412	490163.	1363452.	1268663.	422902.

SIMULATION VA**

INTEREST 5.00 PERCENT, PAY SCALE 3.00 PERCENT, BENEFIT SCALE 3.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT- RET	PENSIONS	NORMAL	PAST SVC COST	TOTAL COST	% OF PAY	UNFUNDED PAST SVC	FUNDS FNDED RATIO	PAY	PVFB ACTIVES	PVFB RETIRED	PVF SERVICE	
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.
2	65	59845.	1634.	36.6	1659.	2179.	8248.	10428.	1.0000	131192.	18531.	0.124	161640.	146184.	16336.	592170.
3	65	59845.	2419.	24.7	2494.	2245.	8496.	10741.	1.0000	133084.	27705.	0.172	63489.	150570.	24185.	592170.
4	65	59845.	3180.	18.8	3330.	2312.	8751.	11063.	1.0000	134932.	36823.	0.214	65394.	155087.	31815.	592170.
5	65	59845.	3916.	15.3	4166.	2382.	9013.	11395.	1.0000	136727.	45893.	0.251	67355.	159739.	39218.	592170.
6	65	59845.	4626.	12.9	5000.	2453.	9284.	11737.	1.0000	138464.	54924.	0.284	69376.	164531.	46394.	592170.
7	65	59845.	5308.	11.3	5832.	2527.	9562.	12089.	1.0000	140134.	63927.	0.313	71457.	169467.	53339.	592170.
8	65	59845.	5960.	10.0	6660.	2602.	9849.	12452.	1.0000	141738.	72915.	0.340	73601.	174551.	60062.	592170.
9	65	59845.	6592.	9.1	7553.	2681.	10182.	12863.	1.0030	143857.	81870.	0.363	75809.	179787.	67154.	592170.
10	65	59845.	7171.	8.3	8484.	2761.	10548.	13309.	1.0075	146266.	90789.	0.383	78083.	185181.	73469.	592170.
11	64	59845.	8570.	7.0	10471.	3155.	11986.	15141.	1.1128	165713.	99999.	0.376	80425.	199562.	92370.	586020.
12	64	59845.	9091.	6.6	11440.	3252.	12416.	15668.	1.1180	168355.	109227.	0.393	82838.	205600.	99596.	586051.
13	64	59845.	9576.	6.2	12427.	3351.	12875.	16227.	1.1242	171145.	118488.	0.409	85232.	211822.	108833.	586091.
14	63	59845.	10885.	5.5	14570.	3821.	14512.	18333.	1.2331	192598.	127155.	0.400	87883.	227655.	126381.	579884.
15	63	59845.	11297.	5.3	15597.	3940.	15048.	18988.	1.2399	195638.	137975.	0.414	90519.	234615.	133788.	579955.
16	63	59845.	11671.	5.1	16621.	4062.	15607.	19669.	1.2470	198648.	147921.	0.427	93235.	241794.	141098.	580013.
17	62	59845.	12862.	4.6	18928.	4621.	17467.	22068.	1.3599	222126.	158477.	0.416	96032.	259240.	162592.	573742.
18	62	59845.	13182.	4.5	19983.	4765.	18110.	22875.	1.3670	225361.	169293.	0.429	98913.	267272.	170178.	573817.
19	62	59845.	13447.	4.5	21031.	4913.	18778.	23692.	1.3746	228399.	180418.	0.441	101880.	275565.	177710.	573876.
20	61	59845.	14567.	4.1	23506.	5576.	20883.	26459.	1.4904	254077.	192392.	0.431	104936.	294828.	201565.	567507.
21	61	58348.	14766.	4.0	24586.	5608.	21643.	27251.	1.5286	257118.	204676.	0.443	105382.	302607.	209552.	561748.
22	61	56852.	14936.	3.8	25663.	5636.	22431.	28067.	1.5687	259965.	217313.	0.455	105760.	310448.	217556.	535903.
23	60	55356.	15984.	3.5	28335.	6216.	24802.	31018.	1.7287	287692.	230863.	0.445	106066.	329267.	244291.	513721.
24	60	53860.	16104.	3.3	29458.	6240.	25690.	31930.	1.7756	290365.	244878.	0.458	106296.	337478.	252974.	497865.
25	60	52364.	16202.	3.2	30584.	6259.	26608.	32867.	1.8252	292729.	259406.	0.470	106443.	345702.	261757.	481960.
26	59	50868.	17195.	3.0	33485.	6873.	29263.	36136.	2.0056	322266.	275027.	0.460	106504.	364832.	291963.	459979.
27	59	49372.	17259.	2.9	34680.	6884.	30290.	37174.	2.0638	324237.	291272.	0.473	106472.	373261.	301682.	444133.
28	59	47876.	17309.	2.8	35889.	6889.	31350.	38239.	2.1255	325757.	308186.	0.486	106343.	381623.	311590.	428258.
29	58	46380.	18273.	2.5	39078.	7534.	34311.	41845.	2.3311	356916.	326362.	0.478	106611.	400644.	345928.	406663.
30	58	44883.	18303.	2.5	40384.	7524.	35490.	43014.	2.4039	357768.	345310.	0.491	105768.	408949.	357032.	390914.
31	58	44883.	18325.	2.4	41715.	7758.	36455.	44893.	1.9780	357997.	357314.	0.500	114969.	368409.	390722.	
32	58	44883.	18341.	2.4	43074.	7998.	37075.	46833.	1.9863	365957.	368812.	0.503	112209.	430657.	380080.	390574.
33	58	44883.	18353.	2.4	44463.	8245.	37048.	38993.	1.9943	373851.	382832.	0.506	115575.	441819.	392062.	390465.
34	58	44883.	18361.	2.4	45886.	8499.	31819.	40318.	2.0020	381658.	396400.	0.509	119043.	453181.	404372.	390390.
35	58	44883.	18366.	2.4	47345.	8760.	32921.	41680.	2.0094	389354.	410559.	0.513	122614.	464736.	417027.	390350.
36	58	44883.	18370.	2.4	48843.	9028.	34054.	43082.	2.0165	396916.	425326.	0.517	126282.	476477.	430061.	390346.
37	58	44883.	18372.	2.4	50392.	9304.	35220.	44524.	2.0232	404316.	440734.	0.522	130081.	488403.	443430.	390379.
38	58	44883.	18374.	2.4	51964.	9588.	36418.	46006.	2.0297	411528.	456813.	0.526	133983.	500499.	457208.	390453.
39	58	44883.	18374.	2.4	53591.	9888.	37613.	47493.	2.0343	418518.	473555.	0.531	138002.	512758.	471389.	390570.
40	58	44883.	18378.	2.4	55264.	10181.	38817.	48997.	2.0376	425296.	490966.	0.536	142142.	525169.	485987.	390729.
41	58	44883.	18375.	2.4	56987.	10490.	38993.	49483.	1.9978	431853.	508009.	0.541	146407.	537719.	501015.	390934.
42	58	44883.	18375.	2.4	58760.	10808.	40221.	51029.	2.0003	439271.	525678.	0.545	150799.	550392.	516488.	391136.
43	58	44883.	18375.	2.4	60586.	11136.	41466.	52601.	2.0018	446502.	543977.	0.549	155322.	563174.	532419.	391491.
44	58	44883.	18628.	2.4	63366.	11470.	41579.	53049.	1.9601	453531.	560860.	0.553	159982.	565786.	559736.	394487.
45	58	44883.	18638.	2.4	65362.	11818.	42836.	54653.	1.9605	461478.	578193.	0.556	164781.	577358.	577106.	395307.
46	58	44883.	18648.	2.4	67417.	12176.	44114.	56290.	1.9604	469239.	595976.	0.559	169725.	588869.	594463.	396233.
47	58	44883.	18914.	2.4	70473.	12542.	44111.	56654.	1.9156	476363.	611955.	0.562	174061.	588863.	625042.	399966.
48	58	44883.	18933.	2.4	72655.	12922.	45365.	58287.	1.9135	484464.	628184.	0.565	180816.	598617.	644010.	401551.
49	58	44883.	18951.	2.4	74900.	13314.	46633.	59947.	1.9106	492313.	646460.	0.567	185462.	608069.	663477.	403316.
50	58	44883.	19230.	2.3	78323.	13715.	46505.	60221.	1.8635	499879.	658769.	0.569	191026.	604467.	696959.	408001.

SIMULATION VB**

INTEREST 5.00 PERCENT, PAY SCALE 5.00 PERCENT, BENEFIT SCALE 5.00 PERCENT, RETIREE SPREAD F = 0.80

T	RET	ACTIVE	RETIRED	ACT-RET	PENSIONS	NORMAL	PAST	SVC	TOTAL	% OF	UNFUNDED	FUNDS	FNDED	PAY	PVFB	PVFB	PVFB
AGE	AGE					COST	COST	COST	COST	PAY	PAST	RATIO			ACTIVES	RETIRED	SERVICE
1	65	59845.	827.	72.4	827.	2116.	8008.	10124.	1.0000	129260.	9297.	0.067	59845.	141927.	8271.	592170.	
2	65	59845.	1634.	36.6	1675.	2222.	8409.	10630.	1.0000	133777.	18717.	0.123	62837.	149023.	16501.	592170.	
3	65	59845.	2419.	24.7	2544.	2333.	8829.	11162.	1.0000	138423.	28271.	0.170	65979.	156474.	24686.	592170.	
4	65	59845.	3180.	18.8	3433.	2450.	9270.	11720.	1.0000	143198.	37971.	0.210	69277.	164297.	32824.	592170.	
5	65	59845.	3916.	15.3	4340.	2572.	9734.	12306.	1.0000	148106.	47836.	0.244	72741.	172512.	40914.	592170.	
6	65	59845.	4626.	12.9	5335.	2701.	10258.	12959.	1.0029	153755.	57891.	0.273	76378.	181137.	49567.	592170.	
7	65	59845.	5308.	11.3	6432.	2836.	10853.	13689.	1.0090	160275.	68001.	0.298	80197.	190194.	59884.	592170.	
8	65	59845.	5960.	10.0	7590.	2977.	11499.	14476.	1.0162	167314.	78287.	0.319	84207.	199704.	68473.	592170.	
9	65	59845.	6582.	9.1	8809.	3126.	12197.	15234.	1.0244	174875.	88715.	0.337	88417.	209689.	78323.	592170.	
10	65	59845.	7171.	8.3	10087.	3283.	12950.	16233.	1.0335	182961.	99296.	0.352	92838.	220173.	88422.	592170.	
11	64	59845.	8570.	7.0	12676.	3824.	15024.	18848.	1.1429	211991.	110433.	0.343	97480.	241879.	111813.	586002.	
12	64	59845.	9091.	6.6	14135.	4018.	15952.	19970.	1.1533	221797.	121790.	0.354	102353.	254035.	123060.	586002.	
13	64	59845.	9576.	6.2	15653.	4221.	16944.	21166.	1.1641	232152.	133392.	0.365	107471.	266805.	134565.	586002.	
14	63	59845.	10885.	5.5	18709.	4906.	19486.	24392.	1.2777	266994.	145745.	0.353	112844.	292316.	162277.	579884.	
15	63	59845.	11297.	5.3	20416.	5156.	20684.	25841.	1.2892	279223.	158457.	0.362	118487.	307103.	175123.	579884.	
16	63	59845.	11671.	5.1	22179.	5419.	21958.	27377.	1.3007	292018.	171578.	0.370	124411.	322646.	188276.	580013.	
17	62	59845.	12882.	4.6	25747.	6284.	25046.	31330.	1.4177	333414.	185739.	0.358	130631.	352641.	221173.	573874.	
18	62	59845.	13182.	4.5	27110.	6605.	26562.	33167.	1.4294	348252.	200484.	0.368	137163.	370627.	235987.	573874.	
19	62	59845.	13477.	4.5	29730.	6943.	28167.	35110.	1.4410	363677.	215887.	0.372	144021.	389547.	251216.	573874.	
20	61	59845.	14567.	4.1	33874.	8031.	31897.	39929.	1.5608	412498.	232736.	0.361	151221.	424870.	290471.	567507.	
21	61	58348.	14766.	4.0	36119.	8233.	33789.	42022.	1.6045	430166.	250276.	0.368	158133.	444549.	307845.	551748.	
22	61	56852.	14936.	3.8	38433.	8434.	35787.	44221.	1.6504	448438.	268578.	0.375	158385.	464923.	325809.	535903.	
23	60	55356.	15984.	3.5	43258.	9482.	40269.	49751.	1.8161	505631.	288499.	0.363	161928.	502680.	372951.	513721.	
24	60	53860.	16104.	3.3	45845.	9701.	42604.	52305.	1.8690	526325.	309384.	0.370	165429.	525220.	393705.	497865.	
25	60	52364.	16202.	3.2	48522.	9918.	45064.	54982.	1.9245	547613.	331313.	0.377	168875.	548467.	415284.	481960.	
26	59	50868.	17195.	3.0	54156.	11102.	50412.	61513.	2.1109	613989.	355236.	0.367	172252.	590055.	472203.	459979.	
27	59	49372.	17259.	2.9	57178.	11333.	53268.	64601.	2.1753	637860.	380420.	0.374	175545.	615410.	497395.	444133.	
28	59	46206.	17395.	2.8	60320.	11558.	56271.	67829.	2.2432	662792.	406949.	0.381	178737.	641416.	523705.	428258.	
29	58	46380.	18273.	2.5	64956.	12885.	62625.	75511.	2.5550	738892.	435851.	0.371	181809.	686459.	592710.	406663.	
30	58	44883.	18303.	2.5	70537.	13115.	66092.	79207.	2.5344	766039.	466313.	0.378	184741.	714293.	623613.	390914.	
31	58	44883.	18325.	2.4	74277.	13782.	61723.	75505.	2.3009	793677.	490857.	0.382	193978.	747304.	655980.	390722.	
32	58	44883.	18341.	2.4	78185.	14483.	65141.	79623.	2.3108	830181.	516837.	0.384	203676.	781706.	689901.	390574.	
33	58	44883.	18353.	2.4	82274.	15217.	68726.	83943.	2.3202	867948.	544348.	0.385	213860.	817539.	725469.	390465.	
34	58	44883.	18361.	2.4	86556.	15987.	72486.	88474.	2.3290	907000.	573482.	0.387	224553.	854845.	762776.	390390.	
35	58	44883.	18366.	2.4	91043.	16796.	76429.	93225.	2.3372	947358.	604337.	0.389	235780.	893664.	801922.	390350.	
36	58	44883.	18370.	2.4	95747.	17644.	80524.	98168.	2.3439	989041.	636975.	0.392	247569.	934036.	843005.	390346.	
37	58	44883.	18372.	2.4	100681.	18534.	84772.	103306.	2.3491	1032110.	671448.	0.394	259947.	974016.	886130.	390379.	
38	58	44883.	18374.	2.4	105858.	19467.	89202.	108669.	2.3534	1076627.	707831.	0.397	272944.	1019594.	931404.	390453.	
39	58	44883.	18374.	2.4	111292.	20447.	93822.	114269.	2.3568	1122639.	746199.	0.399	286591.	1064851.	979939.	390570.	
40	58	44883.	18375.	2.4	116997.	21476.	98641.	120117.	2.3595	1170189.	786628.	0.402	300920.	1111801.	1028850.	390729.	
41	58	44883.	18375.	2.4	122986.	22555.	102403.	124958.	2.3377	1219322.	827930.	0.404	315966.	1160473.	1081261.	390934.	
42	58	44883.	18375.	2.4	129275.	23688.	107586.	131274.	2.3389	1271406.	871324.	0.407	331764.	1210889.	1136297.	391186.	
43	58	44883.	18375.	2.4	135880.	24877.	112992.	137869.	2.3394	1325282.	916879.	0.409	348352.	1263067.	1194091.	391491.	
44	58	44883.	18628.	2.4	144874.	26121.	117147.	143267.	2.3193	1380995.	961115.	0.410	365769.	1293564.	1279733.	394487.	
45	58	44883.	18638.	2.4	152340.	27432.	122943.	150375.	2.3144	1439945.	1007206.	0.412	384057.	1345654.	1345067.	395307.	
46	58	44883.	18648.	2.4	160179.	28810.	128980.	157790.	2.3129	1500841.	1055176.	0.413	403260.	1399132.	1413610.	396233.	
47	58	44883.	18914.	2.4	170693.	30251.	134465.	163166.	2.2855	1562980.	1100956.	0.413	423422.	1426282.	1513914.	399066.	
48	58	44883.	18933.	2.4	179395.	31771.	139834.	171405.	2.27965.	1627965.	1148214.	0.414	444622.	1478063.	1570144.	401551.	
49	58	44883.	18951.	2.4	188528.	33368.	146443.	179811.	2.2768	1695116.	1196906.	0.414	466822.	1530555.	1670022.	403316.	
50	58	44883.	19230.	2.3	200973.	35039.	151264.	186303.	2.2467	1764131.	1242081.	0.413	490163.	1551031.	1788361.	408001.	

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DISCUSSION OF PRECEDING PAPER

LAWRENCE N. BADER:

Mr. Kryvicky has rendered a valuable service in building so thorough a case against current funding practices in negotiated plans. He does not exaggerate when he notes in his conclusion that "the pension landscape is littered with plans in pathological condition." In enumerating the culprits, he has perhaps been too gentle with the actuarial profession. While we do not carry a big stick in making funding decisions, we need not speak as softly as many of us have. It is difficult to blame the collective bargaining process for runaway pension costs. A dollar of pension cost is, after all, no more harmful to a company than a dollar of wages—unless the dollar price tag on the pension improvement is wrong, and whose responsibility is that? It is also difficult to blame the IRS's proscription against recognizing as-yet-unnegotiated plan improvements, while current benefits are being funded at minimum rates allowed by ERISA. Even the change from interest-only funding to the current unsatisfactory funding practice has come less from our own efforts than from ERISA, and, before that, as an unintended by-product of *Accounting Principles Board Opinion No. 8*. It is worth noting that the Royal Commission on the Status of Pensions in Ontario has expressed concern about the inadequacy of *fifteen-year funding* for improvements, as it applies to flat benefit plans.

I hope that this paper will stimulate many of us to educate our clients about the need for accelerated funding. For those who would like to do so but lack access to a model of the type Mr. Kryvicky has used, here is a simple mathematical approach to focus on the nub of the problem, the growth in unfunded liabilities.

Suppose that, for a flat benefit plan, (1) the liability for active employees remains constant, apart from plan amendments; (2) there are no increases for retirees; and (3) there are no actuarial gains or losses. Let b be the annual percentage increase in benefits for active employees due to plan amendments; let u equal $1/(1 + b)$; and let n be the number of years for amortizing unfunded liabilities.

Once funding has stabilized (after n years), the unfunded liability consists of the unamortized portions of liability from the last $n - 1$ increases. We

then have the following (calculations are at the beginning of a year, before the new increase):

1. (a) The most recent increase, expressed as a percentage of current liability for active employees, is $b/(1 + b)$.
- (b) The annual amortization of item 1 (a) is $[b/(1 + b)]/\ddot{a}_{\overline{n}|}$
- (c) The unamortized portion of item 1 (a) is $[b/(1 + b)] \ddot{a}_{\overline{n-1}|}/\ddot{a}_{\overline{n}|}$.
2. The sum of the $n - 1$ unamortized portions is

$$\begin{aligned} & \frac{b}{1 + b} \frac{1}{\ddot{a}_{\overline{n}|}} (\ddot{a}_{\overline{n-1}|} + u\ddot{a}_{\overline{n-2}|} + \dots + u^{n-2} \ddot{a}_{\overline{1}|}) \\ &= \frac{bu}{d\ddot{a}_{\overline{n}|}} [(1 - v^{n-1}) + u(1 - v^{n-2}) + \dots + u^{n-2}(1 - v)] \\ &= \frac{bu}{1 - v^n} \left[\ddot{a}_{\overline{n-1}|} \ddot{a}_{\overline{1}|} - \frac{v(v^{n-1} - u^{n-1})}{v - u} \right]. \end{aligned}$$

If $i = b$, this expression can instead be derived as

$$\frac{1}{\ddot{a}_{\overline{n}|}} [\ddot{a}_{\overline{n-1}|} - (n - 1)v^{n-1}].$$

3. The funding ratio for active employees, or the advance funding ratio, is 1.0 minus the expression in item 2.

For example, suppose an interest rate of 7 percent, annual benefit increases of 6 percent, and thirty-year amortization. Under these conditions, the advance funding ratio will stabilize after thirty years at a level of 37 percent. That is, assets will cover the full liability for retirees and 37 percent of the liability for active employees, *under whatever funding method is used by the plan.*

Higher rates of interest or benefit increase worsen the funding ratio dramatically. An interest rate of 8 percent rather than 7 percent drops the ultimate funding level from 37 percent to 35 percent; a benefit increase rate of 7 percent rather than 6 percent drops the level from 37 percent to 32 percent. If current rates become the norm—say, 12 percent interest and 10 percent benefit increases—the funding ratio would stabilize at just 16 percent. Ten-year funding helps considerably: at 7 percent interest and 6 percent benefit increases, the funding ratio improves from 37 percent to 76 percent.

These results are independent of the size or growth of the retiree population, as long as no retiree benefit increases are given. The approach does

not lend itself to handling retiree increases, although it could readily be expanded to accommodate retiree increases if the retiree liability were constant or increasing by a constant percentage, apart from plan changes.

Even in the absence of retiree increases, the numbers are generally enough to set off alarm bells. Even if all benefit promises are kept, the integrity of corporate financial statements is at issue. The rash of major plant closings of the past few years has reminded us that unfunded liabilities do not stay off corporate balance sheets forever. When a business closes and a large write-off is taken to cover the unfunded vested benefits, the company is only recognizing an expense that would more appropriately have been recognized during the life of the business. Arguably, the profit and loss statement has been wrong, product pricing has been wrong, and negotiation costs have been wrong. Actuaries alone cannot change these things, but we can point out the consequences, and we owe Mr. Kryvicky our thanks for illuminating those consequences.

CHARLES WALLS:

There is a humorous, I hope, draft of Actuarial Examination 13C that circulated through the Education and Examination Committees a few years ago. Question 11, which was merely a 4-pointer, was, "Take a position for or against Truth. Prove the validity of your position." It is in the spirit of attempting to answer the above question in the time allotted that I come to tackling Mr. Kryvicky's paper, in particular the section titled "Conclusion."

There is no actuarial principle that I know of that mandates any particular funding period for any actuarially calculated present value. Funding periods, whether for insurance products, pension plan present values, legal judgments, or anything else, are not actuarial issues but what might loosely be called political issues. For example, all of us, I am sure, have devised insurance products where the premiums for a particular contract are paid after the death of the insured, and, in fact, one of the things Mr. Kryvicky complains about is a pension plan where most of the cost is paid after the employees have retired and perhaps even died. Is there anything that violates an actuarial principle in either of these? Prudent management perhaps, reasonable expectations perhaps, but actuarial principles?—I think not. Leaving aside for the moment the political mandates that constrain us because they are embodied in the laws, is there anything useful that can be said about funding periods? In general, I fail to see anything. In particular, there is no relationship that I know of that ties the funding period for an increase to retired employees to their collective or individual life expectancies. An accountant might refer you to the "useful life" concept, but in this case I do not see that it does much good. The useful life certainly does not

refer to that of the retirees, who have none, but rather to that of the pension plan, which is indeterminate.

I, too, have seen the beached whales of former glorious pension plans that now have more retirees than actives and are experiencing great pain in the cash drawer. On the other hand, they got that way primarily because it was necessary to curtail operations, and being able to retire people gracefully was a godsend both to the employer and, more important, to those employees who still have jobs.

In such a situation, it is not entirely unreasonable to present the following scenario to the remaining employees and their union:

EMPLOYER: Since there was an adequate pension plan here, we have been able to retire half the employees. If we had not been able to do that, they would be the ones still working and you would be the half that would be out with nothing but some supplementary unemployment benefits for a while. However, the hourly cost of the pension plan is now \$4.00 instead of our competitor's \$1.50, and since it takes three hours of direct labor to make a tranafrance that we can sell competitively for \$200, we are now faced with the following arithmetic.

EMPLOYEES: *Boo, hiss!*—We don't want to hear about arithmetic! There will be productivity gains, which will pay for all this.

EMPLOYER: Here is what we are dealing with today:

Tranafrance price	\$200
Direct labor cost @ 3 hours	66
Material	75
Overhead	58
Profit	<u>1</u>
	\$200

If all I'm going to make is \$1 per \$200 sale, I'm closing up.

The problem here could be blamed entirely on the pension plan, since its cost is \$7.50 above the "standard." However, there is still \$18.00 per hour in other wages and benefits that can be bargained about. The major point to be made here is that the problem of the pension plan hardly ever exists in a vacuum.

Who was the villain here, or was there indeed any? Here again, are there any actuarial issues? The employer and employees certainly have a political football to kick around, and different groups of employees have different interests. Suppose everyone is made happy (or at least less unhappy) with a \$2.00 per hour cut in direct wages. What is the actuary for the pension plan to do? Insist on some other funding period?

A word on taxes: I would agree that the policy of the Internal Revenue Service (and also the tax authorities in Canada) may not be entirely consistent from a probabilistic standpoint in allowing contributions to pension

plans to be based on assumptions that include a salary scale if and only if a salary-based plan is provided. The crucial point, however, is that in one case the benefit is legally part of the plan and in the other it is not. From a mathematical point of view this may be irrelevant, but in the world of tax policy it seems entirely consistent and even reasonable.

RICHARD G. SCHREITMUELLER:

Mr. Kryvicky has given us an excellent paper on a timely subject. It is too bad his simulations were not available twenty years ago, when inflation and collective bargaining began taking us into this era of funded pension plans that lack funds.

The paper is especially valuable in going beyond its technical results to suggest a way out of the present funding dilemma. Clearly, it is not acceptable for employers to absorb ever increasing assessments from PBGC and from multiemployer plans. I share Mr. Kryvicky's optimism about possible changes in the classic adversarial attitudes of labor and management. The Japanese have shown what can be done. But in America the adversarial state of mind seems firmly set among typical lawyers, legislators, consumer advocates, management scientists, and others who represent Töffler's "second wave" industrial generation.

An alternative solution to the funding problem is given by Peter Drucker in a December 9, 1981, *Wall Street Journal* article:

The "defined benefits" plan has by now become a deadly trap committing employers to ever increasing contributions both to raise benefits in step with the rise in wages and salaries and to make good portfolio losses in a long-term bear market.

That we cannot go on indefinitely with defined-benefits plans even most union economists now concede, at least off the record. And only a switch to defined contributions can motivate the nation's largest single voter group, retired people and people over 55, to give priority to the fight against inflation.

Otherwise it may be impossible to restore the health of the pension plans. Their main need is beyond the power of even the largest and strongest independent employer. It is to stop inflation.

Mr. Drucker's defined contribution approach to private pension plans resembles the restructuring of social security currently suggested by several conservative economists and actuaries. Perhaps another actuarial paper is needed to test defined contribution pension plans (and floor plans) under a variety of conditions before this movement goes much farther.

The paper shows how modern computers allow actuaries to perform sensitivity tests that can give early warning of possible adverse trends. To me this seems a highly effective and practical way to extend our traditional deterministic approach to problem solving, without tilting at the statistical windmills that are found in the land of academia. (Nonquixotic actuaries

should be concerned about the Society's changing philosophy toward the education and examination of aspirants to Associate status. For example, see Robert W. Batten's written discussion "The Future of Actuarial Education—Is It Ill-conceived?" presented to the Middle Atlantic Actuarial Club in May, 1981.)

In addition to the references given in the paper, one may cite the thought-provoking article "Funding Flat-Benefit Pensions in an Inflationary Era" by Lawrence N. Bader, F.S.A., that appeared in *The Actuary* for February, 1981.

PAULETTE TINO:

Mr. Kryvicky's paper is very interesting indeed. It gives a striking illustration of the effect on funding of the amortization length and of the relative magnitude of the interest rate and the benefit increase rate.

The purpose of this discussion is to give a mathematical expression of the funding ratio (assets divided by accrued liability) using the simple case of a stationary population.

The plan benefit is expressed as a dollar amount per year of service and increases annually at the rate j . Funding starts at time $T = 0$. The initial accrued liability and the additional accrued liability due to benefit increases are funded over thirty-year periods. Contributions and pension payments are assumed to be made at the beginning of the year. Normal costs and amortizations are determined also as of the beginning of the year. The entry-age normal cost funding method is used.

Under such a model, the normal cost, NC , the additional liability, Δ , the pension payments, PP , and therefore the total accrued liability, AL , increase at the rate j . An additional liability is equal to j times the accrued liability for actives AL^A , existing just prior to the increase.

In the following, i is greater than j , and $k = 1/\ddot{a}_{\overline{30}|i}$.

1. *Accrued Liability*

At time $T = n$ the accrued liability is equal to

$$\begin{aligned} AL_n &= AL_0(1+i)^n + (NC_0 + \Delta_0 - PP_0)[(1+i)^n \\ &\quad + (1+i)^{n-1}(1+j) + \dots + (1+i)(1+j)^{n-1}] \\ &= AL_0(1+i)^n + (NC_0 + \Delta_0 - PP_0)(1+j)^n \ddot{s}_{\overline{n}|I} \\ &= AL_0(1+j)^n, \end{aligned}$$

where $I = (1+i)/(1+j) - 1$.

At time $T = 30 + t$, when the initial accrued liability is funded, AL_{30+t} can be expressed as

$$\begin{aligned} AL_{30+t} &= AL_0(1+i)^{30+t} + (NC_0 - PP_0)(1+j)^{30+t} \ddot{s}_{\overline{30+t}|j} \\ &\quad + \Delta_0[(1+i)^{30+t} + (1+i)^{30+t-1}(1+j) + \dots \\ &\quad + (1+i)^{30}(1+j)^t + (1+j)^{30+t} \ddot{s}_{\overline{29}|j}]. \end{aligned}$$

2. Assets

The assets for $n < 30$ are equal to

$$\begin{aligned} A &= (NC_0 - PP_0)(1+j)^n \ddot{s}_{\overline{n}|j} + k(AL_0) \ddot{s}_{\overline{n}|j} \\ &\quad + k\Delta_0[(1+i)^n s_{\overline{n}|i} + (1+i)^{n-1} s_{\overline{n-1}|i} + \dots + (1+i) s_{\overline{1}|i}] \\ &= (NC_0 - PP_0)(1+j)^n \ddot{s}_{\overline{n}|j} + k(AL_0) \ddot{s}_{\overline{n}|j} \\ &\quad + \frac{k\Delta_0}{j} [(1+j)^{n+1} \ddot{s}_{\overline{n}|j} - \ddot{s}_{\overline{n}|i}]. \end{aligned}$$

At time $T = 30 + t$ the expression becomes

$$\begin{aligned} A_{30+t} &= (NC_0 - PP_0)(1+j)^{30+t} \ddot{s}_{\overline{30+t}|j} + AL_0(1+i)^{30+t} \\ &\quad + \Delta_0[(1+i)^{30+t} + (1+i)^{30+t-1}(1+j) \\ &\quad + \dots + (1+i)^{30}(1+j)^t] \\ &\quad + k\Delta_0 \frac{(1+j)^{t+1}}{j} [(1+j)^{30} \ddot{s}_{\overline{29}|j} - \ddot{s}_{\overline{29}|i}]. \end{aligned}$$

3. Funding Ratio

The funding ratio, for $n < 30$, is

$$\begin{aligned} \frac{A_n}{AL_n} &= 1 - \\ &\quad \frac{AL_0[(1+i)^n - k\ddot{s}_{\overline{n}|i}] + \Delta_0\{(1+j)^n \ddot{s}_{\overline{n}|j} - (k/j)[(1+j)^{n+1} \ddot{s}_{\overline{n}|j} - \ddot{s}_{\overline{n}|i}]\}}{AL_0(1+j)^n}, \end{aligned}$$

With $\Delta_0/AL_0 = j(AL_0^0/AL_0) = j\lambda_{ij}$,

$$\frac{A_n}{AL_n} = 1 - \frac{(1+i)^n}{(1+j)^n} \left((1 - k\ddot{a}_{\overline{n}|i}) + j\lambda_{ij} \left\{ \ddot{a}_{\overline{n}|j} - \frac{k}{j} [(1+j)\ddot{a}_{\overline{n}|j} - \ddot{a}_{\overline{n}|i}] \right\} \right).$$

For $T = 30 + t$ the funding ratio is

$$\frac{A_{30+t}}{AL_{30+t}} = 1 - j\lambda_{ij} \left\{ \ddot{s}_{\overline{29}|j} - k \frac{v_j^{29}}{j} [(1+j)^{30}\ddot{s}_{\overline{29}|j} - \ddot{s}_{\overline{29}|i}] \right\}.$$

If $j > i$, then

$$\frac{A_{30+t}}{AL_{30+t}} = 1 - j\lambda_{ij} \left\{ a_{\overline{29}|j} - k \frac{v_j^{29}}{j} [(1+j)^{30}a_{\overline{29}|j} - \ddot{s}_{\overline{29}|i}] \right\},$$

with $I = (1+j)/(1+i) - 1$.

Therefore, after $T = 30$ the funding ratio reaches its limit.

Keeping i at 7 percent, we have for various values of j the following results:

j	A_{30+t}/AL_{30+t}
5%	$1 - 0.577\lambda_{7 5}$
6%	$1 - 0.635\lambda_{7 6}$
7%	$1 - 0.683\lambda_{7 7}$
9%	$1 - 0.754\lambda_{7 9}$

If $j = 5$ percent but the amortization period is twenty instead of thirty years, the funding ratio is $(1 - 0.412\lambda_{7|5})$ instead of $(1 - 0.577\lambda_{7|5})$.

4. Contributions

For $n < 30$ the contribution C_n is

$$C_n = NC_0(1+j)^n + k\Delta_0 s_{\overline{n}|j} + k(AL_0).$$

If $AL_0 = m_{ij}NC_0$, it follows that

$$\Delta_0 = kj\lambda_{ij}m_{ij}NC ;$$

then

$$C_n = NC_0(1+j)^n [1 + kj\lambda_{ij}m_{ij} a_{\overline{n}|j}] + k(AL_0).$$

For $T = 30 + t$,

$$\begin{aligned} C_{30+t} &= NC_0(1 + j)^{30+t} + k\Delta_0(1 + j)^t \ddot{s}_{\overline{30}|j} \\ &= NC_0(1 + j)^{30+t}(1 + kj\lambda_{ij}m_{ij} \ddot{a}_{\overline{30}|j}) . \end{aligned}$$

This latter expression shows that burdensome costs may develop if the salaries increase at the rate j' , with $j' < j$.

BENJAMIN E. FELLER:

Mr. Kryvicky's conclusion "that thirty-year funding of negotiated-plan unfunded actuarial liabilities is a flawed principle" does not surprise me. On what logical basis was the thirty-year period selected?

The funding period should be related to something other than "a good-faith effort to provide for the orderly funding of . . . [the] plans." For example, the following funding periods might be reasonable:

Benefits for active participants	Future average active lifetime of the active participants (which on average is probably twenty to thirty years)
Benefits for retired participants	Future average lifetime of the pensioners (which on average is probably ten to fifteen years)

The funding of benefits for active participants over their active careers, and those for retirees over their future lifetime, prevents the costs for benefit improvements from being passed on to later generations.

A more sophisticated approach, using modern computer simulation, would be to select an appropriate funding ratio (or advance funding ratio) to be achieved over some period and solve for the resulting contributions. Depending on the demographics assumed (increasing active work force, stable active work force, or declining active work force), various contribution patterns could then be studied and analyzed.

Information concerning future trends in contribution rates should be brought to the bargaining table. Both union and management should be aware of what the future trend in costs will be and what contribution rate is necessary to stabilize the annual costs. If contributions are being deferred to the future, eventually someone has to pay. If the plan remains in effect, that someone may be the employer, who will have to make higher contributions. If the plan terminates, that someone will be either the employee, who will receive lower benefits, or the taxpayer, if the Pension Benefit Guaranty Corporation becomes involved.

(AUTHOR'S REVIEW OF DISCUSSION)

ROBERT C. KRYVICKY:

Since it is easier to deal with critics who praise rather than with those who blame, one might be led to believe that I chose to deal first with Mr. Bader simply out of a selfish desire to conceal from my readers the critics who found flaws in my reasoning. On the contrary, however, Mr. Bader deserves kind attention for three other reasons.

First, while this paper was in the hands of the referees, Mr. Bader's excellent article appeared in *The Actuary* in February, 1981. It was omitted from my bibliography, not because of any lack of merit but rather because of the peculiarities of the publishing process. Mr. Bader is to be congratulated on his thoughtful analysis of this serious problem. Any actuary who has an interest in this subject is referred to his short article.

Second, the clever mathematical model that Mr. Bader has devised and illustrated in his discussion gives us a handy way of judging the influences of the significant variables in one particular case. His concise formula is surely much easier to understand than the detailed forecasts presented in my paper. In my defense, I would point out that I deliberately avoided the temptation to devise a series of formulas to illustrate the features of the funding of negotiated plans, because it is my opinion that we do not have at our disposal mathematical techniques that can conveniently summarize all the peculiarities of pension funding in one concise series of formulas. Any model that has so far been devised to explain the pension funding process concisely is founded on a number of very important simplifying assumptions. Regrettably, these simplifying assumptions cannot yet deal fully with the real-world situations we have today. Therefore, we must yield to the brute force techniques offered by modern computers. The technique of fixing all but one variable, and unraveling the consequences through a computer simulation, seems quite natural. Perhaps some day this process will guide a theorist to a concise model that can factor in all the important real-world variables.

Third, I would like to thank Mr. Bader for properly pointing the finger of blame, as least in part, toward the actuarial profession itself. As one client succinctly put it to me after hearing a summary of the results of the paper: "Where was this analysis when we bargained thirty-and-out back in 1965?" Indeed, it seems to me that actuaries should feel a little uncomfortable with the number of plans in pathetic condition today. Surely we have more of a responsibility to our clients than that of simply being a "black box" into which data are poured and out of which recommendations for pension plan contributions are dispensed. Eventually, of course, as man-

agement becomes increasingly astute in the pension aspects of the business, the blame will be properly assigned and the profession will be dealt another black eye.

Mr. Walls is a harsher critic. First, he argues that "one of the things Mr. Kryvicky complains about is a pension plan where most of the cost is paid after the employees have retired and perhaps even died." He asks, "Is there anything that violates an actuarial principle in either of these?" He answers, "Prudent management perhaps, reasonable expectations perhaps, but actuarial principles?—I think not." However, this reasoning is ridiculous. We are not dealing here with problem 23 in chapter 11 of the Society's textbook on life contingencies. American society has given our profession the charge of prescribing what is "actuarially sound" and what is not.

Thirty-year funding has been proved, through harsh experience, to be a flawed principle in the funding of negotiated pension plans. It has produced the "beached whales" that Mr. Walls refers to. The issue is not whether it is possible to fund a plan over thirty or forty years but rather whether it is actuarially sound to do so. If, as I maintain, it is not actuarially sound to fund negotiated pension plans over such long periods of time, then we actuaries, in the proper discharge of our obligations, have a duty to the plan participants to communicate this to both sides of the bargaining table and turn this "political issue" into an issue of prudent fiduciary conduct.

Second, Mr. Walls claims that the beached whales got that way "primarily because it was necessary to curtail operations." This is simply false. Had Mr. Walls read my paper carefully, he would have noticed that the funded ratio for all simulations of the "B" variety (where benefits and pay increase at the same rate as the valuation rate) end up after fifty years with a 45 percent funded ratio. He would also have recalled that one group of these simulations assumed a constant work force. Therefore, the poor funded status of negotiated plans is due to the fact that benefits have increased faster than the rate of increase in investment return—and this is true regardless of what happens to the work force. Of course, as I have shown, drastic work force reductions accelerate the problem. However, more fundamentally, it is the relationship between the rate of increase in benefits and the investment return that is at issue.

Mr. Schreitmueller touches on one aspect of the problem that may turn out to be the force to propel change in this area—the PBGC. If the PBGC gets out of the single-employer plan termination insurance business (as it did with the Multiemployer Pension Plan Amendments Act of 1980), plan sponsors will have a rude awakening. The legislation now in Congress, which would do this by eliminating the "30 percent of net worth" requirement and throwing the full burden of the unfunded vested benefit obligations

on the firm and its creditors, will have a sobering effect on both sides of the bargaining table.

With regard to Mr. Drucker's "solution," I am not at all convinced that defined contribution plans are the answer. Notwithstanding the problems of providing equitable benefits to all employees in all age brackets, it is not entirely clear to me that the defined contribution plan really "saves" the employer anything in the long run. I share Mr. Schreitmueller's hope that an actuary will take the issue and explain the problem with the approach before the movement gains any further steam.

I thank Ms. Tino for her delightful mathematical explanation of the limiting values of the funded ratio. When I discovered that there were certain fixed funded-ratio limiting values in the simulations, I knew that some actuary would be intrigued enough to ask why. Ms. Tino did not disappoint that expectation—at least in the case of the stationary population. Curiously, my paper demonstrates that the same limiting values are achieved even if the population is not stationary. If the population is perturbed, say by the reduction of the average retirement age or by a periodic hiring freeze or even by a sustained decline in the total population, essentially the same limiting values are attained. Surely there must be an equally succinct reason why that happens.

Finally, Mr. Feller points out some very logical approaches to the proper selection of a funding period. I have seen some plans with funding periods selected in accordance with Mr. Feller's suggested approach. After a short period of years, the plans return to a much more healthy funded status. In this regard, I refer the readers to the article written by Harry E. Figgie, Jr., entitled "Defusing the Pension Liability Bomb," which appeared in the November–December, 1981, issue of the *Harvard Business Review*. In this article, Mr. Figgie suggests an approach to bargaining that integrates the funding period with the benefit amount.