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3. Projections of Benefit Payments, Contributions, and Fund Accumulations

The preceding chapter discussed the projections of the number of covered workers and beneficiaries; this chapter will derive the money amounts that are of primary concern—contributions, earnings, benefit payments, and, their net resultant, pension fund accumulations. Projection of total contributions and benefit payments was done as follows. Given some number of covered workers (W) and an estimate of contributions per worker (C/W), then total contributions (C) is derived as their product. Similarly, total benefit payments are estimated as the product of B and P/B, were B is the number of beneficiaries and P/B is payments per beneficiary.

The earlier discussion indicated that, for covered workers, and beneficiaries, developing a number of alternative estimates was the best method; no single estimate could be suggested as unequivocally the best. Similarly, several estimates of C/W and P/B were used. Each of them incorporates either a realistic possibility or illustrates the implications of a particular policy imposed on the composite pension structure through specified accomplishments in OASDI or private industrial plans. In any event, each C/W and P/B is explained, and the reader has a basis for choosing from among them as he wishes.

While no particular C/W and P/B could be defended strongly enough to exclude all others, one group, analyzed in the chapter that follows, seemed the natural and likely one because it is based on the structure of industrial pension plans. Alternatives are examined in Chapter 6.

The physical magnitudes—number of covered workers and beneficiaries—described by two symbols (i.e., our A_iC_j) have already been determined and are relevant within very broad limits no matter what assumptions a particular $(C/W)_i$ or $(P/B)_i$ may be based on.

Assume that the existing set of industrial pension plans constitutes a structure or a system that has a dynamics (or momentum) that will persist over the next twenty years and whose essence can be captured from the experience of the last decade. In other words, assume that the forces that determine (C/W) and (P/B) will operate in the same way over the next generation as they have over the last decade. Thus each year's C/W and P/B can be derived by projecting its values from a linear regression on time. It is more convenient to start with the estimate of P in which deriving P/B is the first stage.

Specifically, the linear trend for P/B computed for the period 1950–61 was:

$$P/B = \$845.38 + \underset{(\$2.43)}{\$16.94}X,$$

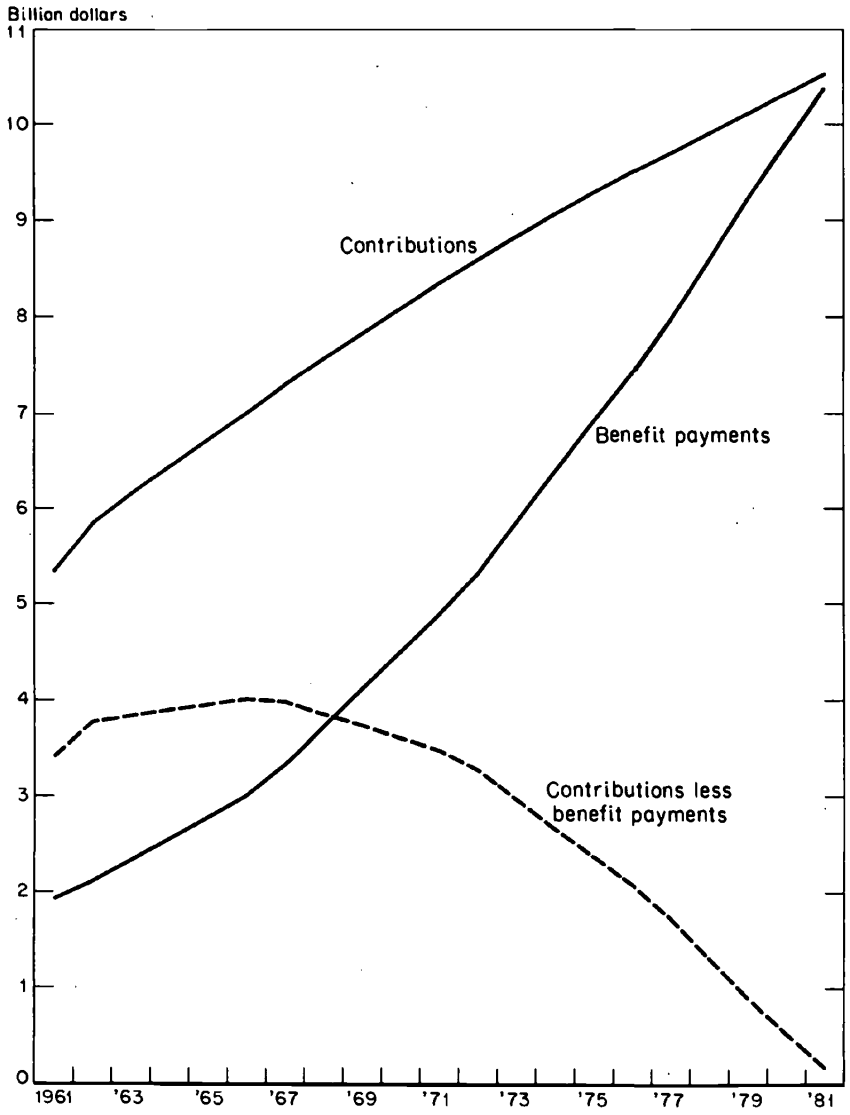
where X = time = 1, 2, . . . , n, and the number in parentheses is the standard error of the slope coefficient. This is a satisfactory regression; with an R (correlation coefficient) of .92, about 85 per cent of the variation in P/B is explained, and the coefficient of the time variable is significant at the .01 (or .001) level. Thus the projected value for 1962 was equal to $\$845.38 + 12\ (\$16.94) = \$1{,}048.66$, and for 1981 it was $\$845.38 + 31\ (\$16.94) = \$1{,}370.43$, with each year differing from the previous one by \$16.94.

Basic tables incorporating all the projections and their components have been compiled.[1] Those in the set based on (P/B) and (C/W) derived from trends are designated by a triple of numbers and letters —e.g., (A_i, C_j, r_k), where r is either an interest rate or $C + E$ (contributions plus earnings)—and comprise the first eighty pages of the supplement. (The most "likely" projections in this set constitute the basis for the discussion in Chapter 4.) In Chart 3 projected benefit payments (along with contributions and the excess of contributions over benefit payments) are plotted for the years 1962–81 for one of the two preferred projections—$A_{.25}C_3$. Under this set of assumptions, total benefit payments, which come to \$1.9 billion in 1961, are projected at \$3.0 billion for 1966, \$4.9 billion for 1971, \$7.4 billion for 1976, and \$10.4 billion for 1981. This, of course, is a sharp increase, but it is not unreasonable. Indeed, a really pronounced rise in benefit

[1] The complete set of tables referred to as the tabular supplement are on file at the library of the National Bureau.

CHART 3

Projected Benefit Payments, Contributions, and the Differences Between Them Under Projection $A_{.25}C_3$, Private Industrial Pension Plans, 1961–81



Source: Tables 24 and 25.

payments is to be expected as the lagged counterpart of the spurt of contributions witnessed over the last two decades. However, benefit payments are not "running away," which can be seen from the declining rate of growth as summarized by the year-to-year percentage changes in Table 24 and the faint suggestion of a maximum absolute annual change in 1978. The trend-projected growth in (P/B) is modest,

TABLE 24

Projected Number of Beneficiaries, Total Benefits, and Year-to-Year Percentage Change in Benefits, Private Industrial Pension Plans, Projection $A_{.25}C_3$, 1962-81

Year	Average Number of Beneficiaries[a] (thousands)	Benefits Per Beneficiary (dollars)	Total Benefits (billion dollars)	First Difference in Total Benefits	Year-to-Year Percentage Change in Total Benefits
1962	1,993	1,049	2.09	–	–
1963	2,179	1,066	2.32	0.23	11.0
1964	2,360	1,082	2.55	0.23	9.9
1965	2,535	1,099	2.79	0.24	9.4
1966	2,703	1,116	3.02	0.23	8.2
1967	2,936	1,133	3.33	0.31	10.3
1968	3,235	1,150	3.72	0.39	11.7
1969	3,524	1,167	4.11	0.39	10.5
1970	3,800	1,184	4.50	0.39	9.5
1971	4,060	1,201	4.88	0.38	8.4
1972	4,378	1,218	5.33	0.45	9.2
1973	4,753	1,235	5.87	0.54	10.1
1974	5,110	1,252	6.40	0.53	9.0
1975	5,449	1,269	6.91	0.51	8.0
1976	5,765	1,286	7.41	0.50	7.2
1977	6,122	1,303	7.97	0.56	7.6
1978	6,520	1,320	8.60	0.63	7.9
1979	6,898	1,337	9.22	0.62	7.2
1980	7,251	1,354	9.81	0.59	6.4
1981	7,576	1,370	10.38	0.57	5.8

Source: NBER projections.

[a]Average number of beneficiaries in year t is equal to the average number at the end of years $t-1$ and t.

just under $17 per year, the great increase in benefit payments being due to the sharp increase in beneficiaries.

Initially the attempt was made to derive C/W in the same way as (P/B) i.e., by extending the trend as measured from the data for the period 1950–61. The regression of C/W on time was:

$$C/W = \$262.06 - \$1.02\,X, \qquad (\$0.79)$$

where, as before, X = time = 1, 2, . . . , n. This regression is not very useful, however. The size of the standard error of the slope coefficient indicates that it is not significant by any reasonable standard. Moreover, the coefficient of X is so small that it makes little difference if the constant term alone is used. Further, the minus sign on the coefficient is not appropriate for projecting into the future, since the likelihood for a continually decreasing C/W, no matter how slightly decreasing, is not great. Finally, R is .39, which means that only 15 per cent of the variation in C/W can be "explained" by time. The explanatory value of this equation is close enough to zero to be considered negligible. It seemed preferable, all things considered, simply to average C/W for the last four years for which data were available and to use this constant value ($252.10) [2] as the projected C/W.

Is it not peculiar to project a constant C/W over the next twenty years for the industrial pension plan structure? In other words, is not the projection of a constant C/W inconsistent with the projected increase in P/B; i.e., do not rising benefit payments per beneficiary require increasing contributions per covered worker? The answer is, not necessarily. Indeed, there are good grounds for expecting a substantially unchanged C/W over the future. First, as more and more workers are covered for a longer and longer period, less in the way of contributions will be required on the score of past service credits, so a seemingly monetarily constant C/W will be *de facto* a rising one. Moreover, earning rate assumptions incorporated in private industrial pension plans have proved more conservative than actual results; and if this differential continues, contributions will not have to increase as much as they otherwise would have. Finally, the increments to coverage over time will generally involve less generous pension arrangements

[2] Computed from *Social Security Bulletin*, April 1963, p. 12, Table 5.

than those incorporated in the already established plans or than those for currently covered workers (because of younger ages and lower than average rewards); therefore, a component with contributions lower than average will be added to the total each year, tending to tone it down.

Annual values of the C_3 projection's total (employer and employee) contributions appear in Table 25. Contributions too are expected to grow substantially over the twenty years between 1961 and 1981.

TABLE 25

Projected Annual Total Contributions and Year-to-Year Percentage Changes, Private Industrial Pension Plans, Projection C_3, 1962-81

(billion dollars)

Year	Contributions	First Difference of Contributions	Year-to-Year Percentage Change in Contributions
1962	5.85	–	–
1963	6.15	0.30	5.1
1964	6.44	0.29	4.7
1965	6.73	0.29	4.5
1966	7.02	0.29	4.3
1967	7.30	0.28	4.0
1968	7.57	0.27	3.7
1969	7.84	0.27	3.6
1970	8.10	0.26	3.3
1971	8.35	0.25	3.1
1972	8.60	0.25	3.0
1973	8.83	0.23	2.7
1974	9.06	0.23	2.6
1975	9.28	0.22	2.4
1976	9.49	0.21	2.3
1977	9.70	0.21	2.2
1978	9.90	0.20	2.1
1979	10.11	0.21	2.1
1980	10.32	0.21	2.1
1981	10.54	0.22	2.1

Source: NBER projections.

From $5.3 billion in 1961, they are projected to be $7.0 billion by 1966, $8.4 billion by 1971, $9.5 billion by 1976, and $10.5 by 1981. Thus they will almost double over the twenty years. (This, of course, is at the same rate as the growth of coverage over this period, since (C/W) is projected as unchanged over the whole of the twenty years.) That growth is considerably less vigorous than the projected spurt in benefits, and indicates a credible relation between benefits and contributions that helps to keep fund accumulations from becoming explosive.[3] That the first differences of total contributions tend to tail off over time is a comforting feature of the projections.

Looking back to Chart 3, we note that contributions and benefits appear as smooth curves. Smoothness, of course, is a function of how the variables were projected; it is not a guarantee that there is any inherent economic sense in the projections. Yet, because many economic processes have this characteristic, it does the projections no discredit. And the shape of the difference between total contributions and total benefits rises smoothly to a maximum and then declines.[4] This maximum difference between them is a credible feature of a pension plan and of a set of plans, i.e., a pension structure, but should not be confused with the net annual additions to pension funds.[5]

In projecting pension fund earnings, it seemed once again most reasonable to use alternative assumptions. The rates assumed by actuaries in developing plans could not be used, for clearly they are tentative, subject to revision, and generally too low.[6] Nor was it clear what past experience indicated for the future course of interest rates.

[3] Such a relation helps, but it does not by itself necessarily determine this result, for fund earnings also have to be considered. Earnings are discussed below.

[4] In Chart 3 the specific data of $A_{.25}C_3$ are plotted. The difference between contributions and benefits peak in different years for the different projections. Details are not important for the purpose at hand, and differences among the various projections can be most efficiently discussed by examining fund levels and annual changes, i.e., the net resultant of the size of the flow of benefits, contributions, and fund earnings.

[5] Fund earnings and benefit payments were about the same size in the middle and later 1950's, and therefore contributions turned out to be equal to the net annual additions to pension funds. That this will not generally be the case in the future will be clear from the projections.

[6] For example, for 1954, of 117 self-administered single-employer plans in New York State surveyed, all but six assumed earnings rates below 3 per cent, with 85 of the plans reporting the assumed interest rate at 2.50 or less. State of New York, Insurance Department, *Private Employee Benefit Plans—A Public Trust*, 1956, p. 172. This is generally referred to as the "House" Report, after Martin House who headed the research staff.

In the early 1950's, 3.5 per cent on book value seemed reasonable; by the end of the decade, closer to 4 per cent.[7] Currently the rate is probably somewhat higher.

Therefore, it seemed appropriate to establish likely ranges of values, and to this end interest rates of 3.5, 4.0, and 4.5 per cent were incorporated in the projections. The lowest of these was chosen out of deference to history; 4.0 or 4.5 is really the more likely. There is little ground for preference between these two; therefore, projections using both are presented. And, of course, other things equal, greater fund accumulations would be expected with the 4.5 per cent rate than with 4.0. However, this could well be a false or misleading finding for if earnings are consistently higher, but everything else is unchanged, contributions will tend to fall because a higher proportion of the fund can be built up from earnings. Thus fund accumulations might not be too different whether the interest rate was 4.5 or 4.0 per cent. Indeed, it is probably sensible to concentrate on projections based on one particular earning rate assumption, since the likelihood is that, if, in fact, other rates did prevail, compensating adjustments in contributions would keep funds from accumulating as rapidly (or cause them to accumulate more rapidly) than would otherwise be the case. Therefore, emphasis will be placed on the projections that assumed a 4 per cent rate of earnings. The reader who prefers either 3.5 or 4.5 per cent will find the appropriate projections in the supplement on file at the National Bureau of Economic Research.

The fact that, if earnings rates are high or low, contributions might well be adjusted in compensation suggests that it might be useful to isolate the behavior of earnings and contributions combined, call it $C + E$, and project $C + E$ for the years 1962–81 on the basis of this relation.

Following the procedure used for projecting (P/B), contributions plus earnings per covered worker $([C + E]/W)$ were regressed on time for 1951 through 1961:

$$[C + E]/W = \$270.16 + \$6.11\ X,$$
$$(\$1.27)$$

[7] Thus corporate pension funds earned 3.7 per cent on book value in 1956 and 4 per cent in 1960. Computed from data in "Corporate Pension Funds," SEC, *Statistical Bulletin,* May 1961, pp. 9–15 (investment income divided by average of total book value of assets at beginning and end of year minus one-half investment income).

where X = time = 1, 2, . . . , n, starting with 1951. The size of the slope coefficient related to its standard error (in parentheses), plus the fact that $R = .85$ (i.e., about 73 per cent of the variation in $[C + E]/W$ is explained by variation in X) indicates that this is a "good" relation. From this trend, annual values of $[C + E]/W$ for 1962–81 were projected, and this provided the basis, given W, for estimating $C + E$. From $C + E$ we subtracted P, estimated as described earlier, to arrive at each year's net additions to pension fund holdings.[8]

In summary, then, for every A_iC_j combination there were two ways of proceeding. One involved estimating benefit payments, contributions, and fund earnings via an assumed interest rate; the other called for estimates of benefit payments and contributions plus earnings as a combined total. In principle, there is little to choose between them; therefore the results of both procedures are presented and analyzed in the next chapter.

[8] Later, starting with Chapter 4, the symbol P is also used to designate a projection set. No confusion should stem from this duplication of symbols, however, for whenever P stands for a projection set it is always followed by a number subscript.