NBER WORKING PAPER SERIES

PENSIONS AS SEVERANCE PAY

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Working Paper No. 944

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

July 1982

This paper was presented at the conference on Financial Aspects of the U.S. Pension System, Amelia Island, Florida, March 25-26, 1982. The research reported here is part of the NBER's research programs in Labor Studies and in Pensions. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #944
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Abstract

"Pensions as Severance Pay"

Earlier claims that pensions serve as severance pay are corroborated by a new data set drawn from the 1980 Banker's Trust corporate pension plan study. A model is developed that shows how pension values which vary with the age of retirement make both workers and firms better off by moving the equilibrium in the direction of a perfect-information, first-best optimum. This requires that pension values decline with the age of retirement beyond a certain point. Evidence from the 1975 and 1980 data sets supports this claim. To the extent that any significant change has occurred between 1975 and 1980, most important is that the ratio of early retirement pension value to normal retirement pension value has increased.

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When wages equal marginal product and workers are risk-neutral, severance pay is not merely superfluous--it is harmful. However, when either of these conditions is violated severance pay becomes an important part of an optimal compensation scheme. For example, if the contemporaneous wage exceeds marginal product then workers prefer to remain with the firm even when it is inefficient to do so. Severance pay causes the worker to leave the job more frequently and a judiciously chosen combination of wage and severance pay can induce efficient quitting behavior.

Pensions which vary with the date of retirement can be thought of as a form of severance pay. If the expected present value of the pension declines with later retirement, then the worker sacrifices some benefits to remain on the job. Stated conversely, firms appear to be willing to pay a larger pension value (stock, not flow, of course) to workers who retire early. These larger pensions can be interpreted as severance pay since they induce the worker to leave the job more frequently than he would in the absence of such a structure.

This view of pensions is quite different from the one that holds that pensions are a way to save at before-tax rather than after-tax rates of interest. Although there must be some truth to the notion that pensions function as a tax-free savings account, this view alone is inconsistent with the finding (presented below) that the expected value of the pension stream declines with increased age of retirement. Since nothing is withdrawn explicitly from the account until retirement, the value of pension benefits should be strictly increasing in age of retirement under the savings account interpretation of pensions. The widespread existence of pensions which decline with age of retirement is evidence for the notion that pensions act as a form of severance pay to insure efficient labor mobility.

Below, a theory of severance pay is presented and specific implications of that theory to pensions are derived. The theory is tested using data which I generated using the 1980 Bankers' Trust Corporate Pensions Plans Study. The results are then compared to those obtained using a similar data set for 1975 which was analyzed in a previous study (Lazear (1981)).

The major findings are:

(1) Although severance pay does not always guarantee efficient labor mobility, approximately chosen severance pay moves the economy in the direction of the perfect information optimum under almost all circumstances.

(2) Most major pension plans in both 1975 and 1980 pay a larger expected present value of pension benefits for early retirement. This is consistent with the view that pensions act as severance pay, but inconsistent with the notion that pensions are merely a tax-deferred savings account.

(3) The structure of pensions between 1975 and 1980 does not appear to have changed dramatically. Either ERISA's (1974) effect was almost fully captured by the 1975 data or it did not have a significant effect on pension values.

(4) There was about a 50% increase in the average nominal value of pensions across the board between 1975 and 1980. Additionally, there was over a 100% increase in the value of pensions taken ten-years before the date of normal retirement for pattern skews. This may have been a reaction to changes in the Age Discrimination in Employment Act which restricted mandatory retirement clauses.

The Model

The first task is to derive a simple model of severance pay.[1] To begin, consider a two-period world in which workers are risk neutral. The terms of trade between the worker and firm are set in period zero and work, if it occurs at all, takes place during period one. For the moment, we do not elaborate the reasons for setting up a contractual arrangement when a spot market might appear to perform as well or better. Simply take the two-period construct as given.

Define the wage at which trade occurs in period one as W, the worker's value to the firm as V and the value of his alternative use of time as A. If work takes place, the worker receives W, but work does not occur in the event of a "quit" or "layoff," each of which is determined unilaterally. A worker quits if and only if $A > W$ and the firm lays the worker off if and only if $V < W$.

Work is efficient whenever $A < V$. Under these circumstances, appropriate transfers could make all parties better off if work occurs. But if W equals neither A nor V, work will not always occur when it is efficient. To see this, consider figure 1. Work is efficient whenever the realization of V, A lies to the southeast of the $A = V$ line. Suppose that the wage which is negotiated is W. The worker quits whenever $A > W$ or whenever the realization of A is above the horizontal line at W. Some of these quits are efficient since the worker quits when $A > W > V$ and when $A > V > W$, both of which imply that $A > V$ so that the separation should occur. But some of those quits are inefficient since the worker also quits when $V > A > W$. These points are shown in the triangle labeled "inefficient quits." The problem is that the worker can unilaterally determine a separation and he has no incentive to take into account the fact that although

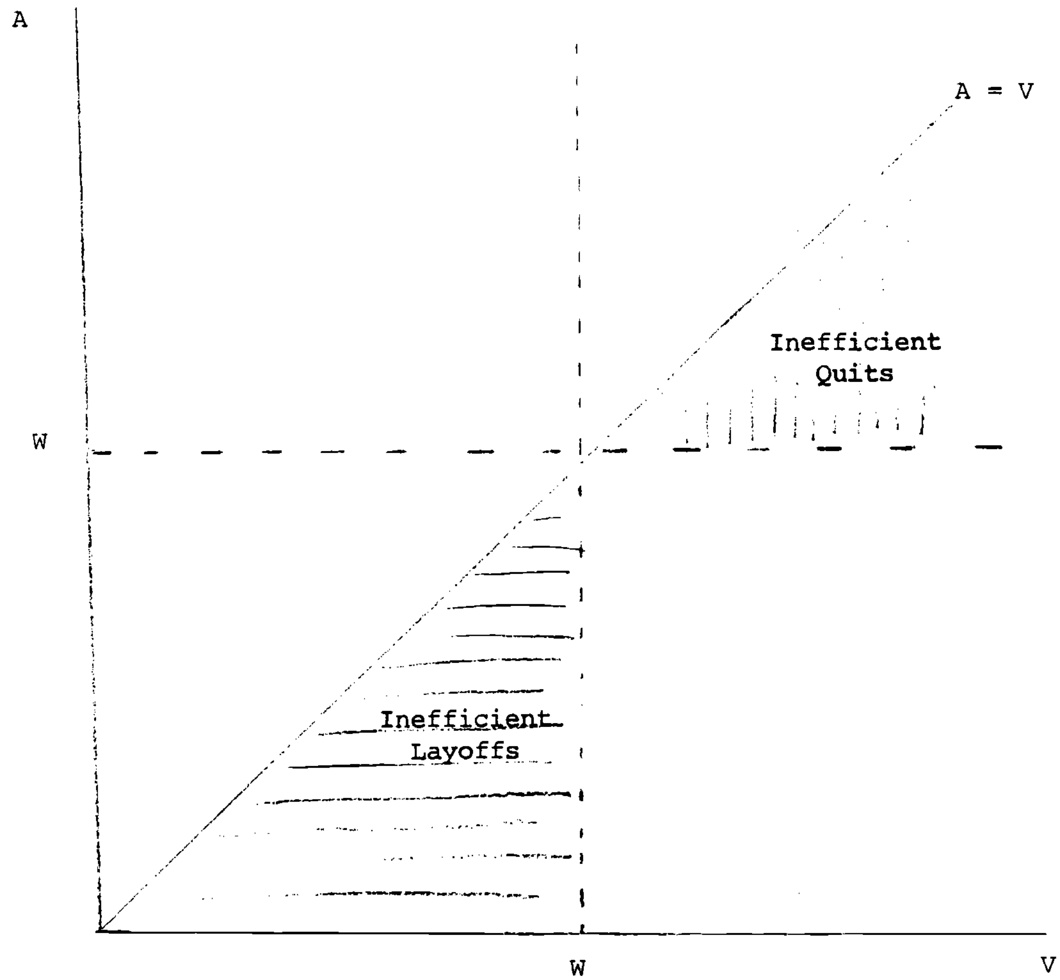

Figure 1

his alternatives are relatively good, he is worth even more to society at his current job.

The converse is also true. The firm unilaterally determines that a layoff occurs whenever $V < W$. In the diagram, layoffs occur whenever the realization of V is to the left of the vertical line at $V = W$. Some of these layoffs are efficient because the firm lays the worker off when $W > A > V$ and when $A > W > V$, both of which imply that $A > V$. So that a separation should occur. But some are inefficient because the firm also lays workers off when $W > V > A$, shown in the triangle labeled "inefficient layoffs." The problem here is that the firm can unilaterally determine a separation and it has no incentive to take into account the fact that although the worker is worth little to the firm, his alternative use of time is even lower.

Labor market situations seem to resemble this simple set-up. Workers have better information about their alternatives than firms and firms have better information about the worker's worth to the firm than the worker. Wages or wage profiles are somewhat rigidly fixed in advance so that the bilateral monopoly situation which arises after the values of A and V are known does not lead to costly negotiation about how rent is to be split.

Now consider the role of severance pay. Suppose that the argreement which is negotiated at time zero includes the provision that work takes place at wage W, but that a payment S is made from firm to worker if a serpartion occurs.[2] The worker quits iff $A + S > W$ or iff $A > W - S$. The firm lays the worker off iff $W - V > S$ or iff $V > W - S$.

If both W and S are free to vary, severance pay adds nothing to the analysis. We can simply define $W^* = W - S$ and the previous discussion carries over perfectly to this case as well.

Severance pay is interesting when W or S is not free to vary so that the wage that minimizes the loss due to inefficient separation either is infeasible or is undesireable by some other criterion. In the static context, the division of rent provides a motivation for a separate wage and severance pay. Since $V > A$ automatically implies that rent is generated as the result of trade, that rent must be split up. It is desireable that the way in whic rent is shared should not affect the allocation of resources. A two-part wage is sufficient to bring this about. The worker receives S even if no work occurs so $W - S$ is the marginal payment for work and it is this value that affects behavior.

For example, suppose that $V = \bar{V}$ were known with certainty by all parties. Then if $g(A)$ is the density of A, the expected rent associated with the activity is

$$\bar{V} - \int_{-\infty}^{\bar{V}} A\, g(A)dA$$

if no inefficient separation occurs. This value can be realized only if work occurs whenever $A < \bar{V}$. If the marginal payment to work is set equal to $\bar{V}$, a layoff never occurs and quits occur iff $A > \bar{V}$. Thus, $W - S = \bar{V}$ is efficient. The split of the rent is a bargaining problem, but it is clear that any level of S chosen is consistent with $W - S = \bar{V}$ since W is free to vary. Thus, the rent sharing arrangement pays S and the additional degree of freedom provided by W insures separation efficiency.

A pension can be though of as this most simple form of severance pay. After signing the contract (becoming vested, perhaps), the worker can quit and receive the pension S, or he can continue to work in which case he receives W - S for work plus a pension of S upon retirement. Below, we enrich the definition of severance pay to encompass the more elaborate forms that pensions take, but the simple notion that a pension may function as a form of severance pay remains.

In this static context, the timing of S is inconsequential. It can be paid during period zero or after period one so that the term "severance pay" may be somewhat misleading. In the dynamic context, the timing of the payment may be crucial. The fact that contracts are not costlessly enforced seems to be a major part of the story and it is this aspect of the problem that makes it necessary that the lump sum part of payment, the severance pay, be paid after employment ceases.

One situation in which it is important that severance pay follow employment arises when effort cannot be monitored costlessly. As has been argued elsewhere (Becker and Stigler (1974 and Lazear (1979, 1981)), deferred compensation can act as an incentive device to bring about an efficient amount of effort on the job. A pension given upon retirement may be regarded as a reward for service well done and the existence of such a reward induces workers to avoid shirking over their worklives. But a pension awarded only upon retirement is not, in general, the best way to produce this result. I have shown that under a number of circumstances, it is preferable to combine some pension upon retirement with an age-earnings profile which rises more rapidly than worker productivity.

The difficulty associated with steeply rising age-earnings profiles is that they distort the labor supply/separation decision. Mandatory retirement is one institutional adaptation which has arisen to alleviate the harmful effects of that distortion. But the problem is one which affects the worker and firm in all periods of their partnership and is not specific to

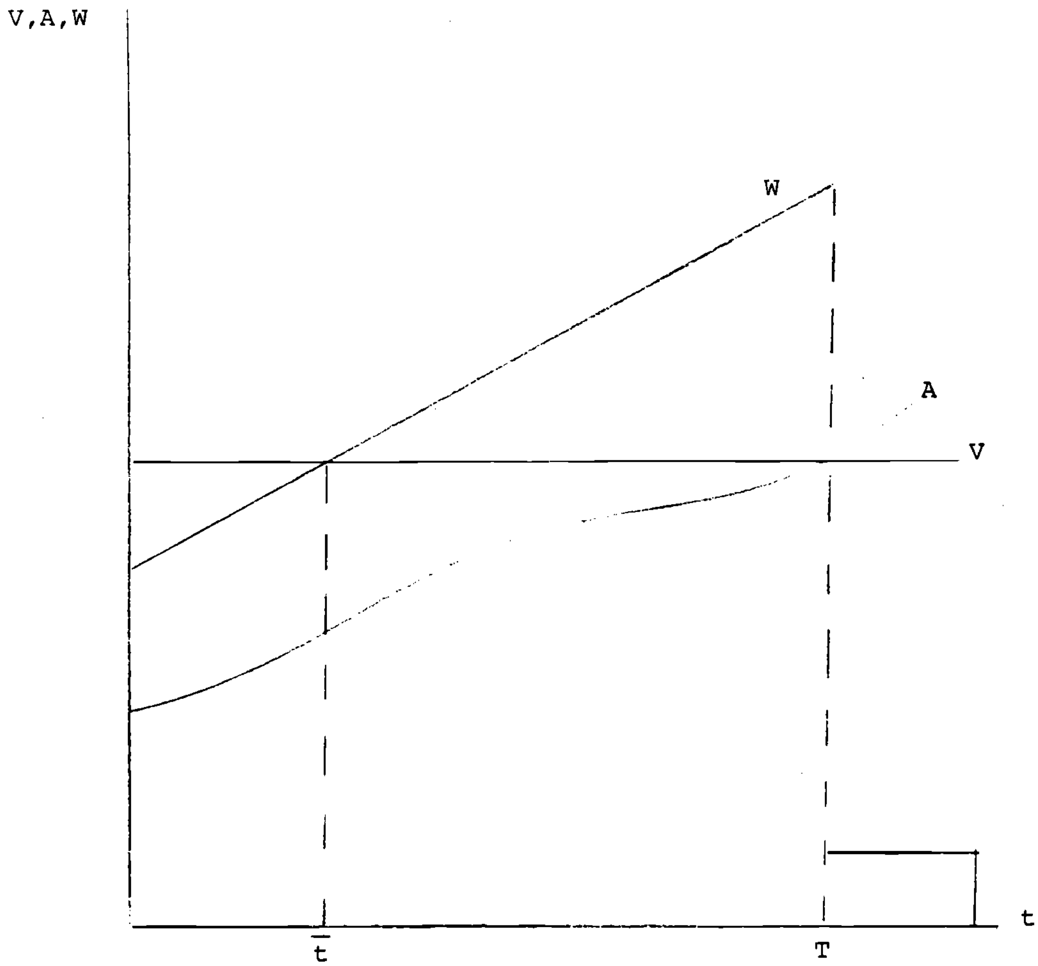

Figure 2

retirement. In the vocabulary of the earlier discussion, if W exceeds V , then the worker will not leave the job when it is efficient for him to do so. The firm, on the other hand, is too anxious to rid itself of the worker. If V is known to both worker and firm, then it is easy to set up an arrangement that will guarantee both optimal effort and efficient separation. That scheme involves the use of an upward-sloping age-earnings profile with some pension after retirement at the normal age. All separations are initiated by workers except in the case of effort below the required level. Under that circumstance, the worker is fired and loses the right to draw high future salary and perhaps some pension device since the expected present value of the pension, and therefore of the severance pay, varies with age of retirement. Let us formalize the approach.

We broaden our model to consider a situation in which workers remain with a particular firm for a number of periods. Define T as the period of "normal" retirement. (As will be argued below, "normal" retirement is nothing more than the modal age of retirement because with efficient severance pay, workers leave the firm appropriately.) A typical profile with wage not equal to marginal product is shown in figure 2. Here, wage, labeled W , starts out below worker's marginal product, V , and then rises above it. The distortion occurs because the worker reacts to the relationship between his alternative, A , and W , rather than to the relationship between his alternative, A , and marginal product, V . Severance pay can eliminate the distortion.

Utility maximization implies that a worker quits and accepts severance pay if two conditions hold: (1) the present value of severance pay plus the alternative stream exceeds the present value of the wage stream in the current firm and (2) the worker cannot do even better by delaying his retirement to some time in the future.[3] In period $T - 1$, the worker retires if

$$(1) \quad A_{T-1} + S_{T-1} \sum_{\tau=0}^{K+1} \frac{1}{(1 + r)^{\tau}} > W_{T-1} + \left(\frac{1}{1 + r} \right) S_T \sum_{\tau=0}^{K} \frac{1}{(1 + r)^{\tau}}$$

where K is the number of years beyond normal retirement age that the individual lives, S_t is the annual pension payment received from t until death, if the worker retires at t and r is the discount rate.

To induce efficient quitting behavior, it is necessary that the l.h.s. of (1) exceeds the r.h.s. of (1) iff $A_{T-1} > V_{T-1}$. If

$$P_{T-1} \equiv S_{T-1} \sum_{\tau=0}^{K+1} \frac{1}{(1 + r)^{\tau}} \quad \text{and} \quad P_T \equiv S_T \sum_{\tau=0}^{K} \frac{1}{(1 + r)^{\tau}} \quad \text{then}$$

choose P_T and P_{T-1} so that

$$(2) \quad P_{T-1} - \left(\frac{1}{1 + r} \right) P_T = W_{T-1} - V_{T-1} .$$

Substitution of (2) into (1) yields the necessary and sufficient condition that the worker quits if

$$(3) \quad \begin{aligned} &A_{T-1} + W_{T-1} - V_{T-1} > W_{T-1} \\ &\text{or} \\ &A_{T-1} > V_{T-1} \end{aligned}$$

Since this is the efficiency condition, the severance pay arrangement results in efficient turnover.

Now consider the decision at $T - 2$. The worker resigns at $T - 2$ if and only if two conditions hold: First, the present value of retiring at $T - 2$ and receiving severance pay must exceed the present value of continuing to work until $T - 1$ and retiring then, taking the $T - 1$ severance pay. Second, the present value of retiring at $T - 2$ with severance pay must exceed the present value of working until T and taking the normal pension. If we make the assumption that $A_t > V_t$ implies $A_{t'} > V_{t'}$ for $t' > t$ then the second condition becomes redundant (demonstrated below).

Consider the first condition: A worker retires at $T - 2$ rather than at $T - 1$ iff

$$
\begin{aligned}
(4)\quad & A_{T-2} + \frac{E_{T-2}(A_{T-1})}{1 + r} + S_{T-2} \sum_{\tau=0}^{K+2} \frac{1}{(1 + r)^{\tau}} > W_{T-2} + \frac{E_{T-2}(A_{T-1})}{1 + r} \\
& + \frac{S_{T-1}}{1 + r} \sum_{\tau=0}^{K+1} \frac{1}{(1 + r)^{\tau}}
\end{aligned}
$$

where $E_{T-1}(A_{T-1})$ is the expectation of the alternative wage offer at $T - 1$ given the information at $T - 2$.

For efficiency, it is necessary that the l.h.s. of (4) exceed the r.h.s. iff $A_{T-2} < V_{T-2}$ (which, by assumption, implies $A_{T-1} < V_{T-1}$). An efficient pension plan sets

$$
\begin{aligned}
(5)\quad & P_{T-2} - \frac{1}{(1 + r)} P_{T-1} = W_{T-2} - V_{T-2} , \\
& \text{or} \\
& S_{T-2} \sum_{\tau=0}^{K+2} \left(\frac{1}{1 + r} \right)^{\tau} - \frac{S_{\tau-1}}{1 + r} \sum_{\tau=0}^{K+1} \left(\frac{1}{1 + r} \right)^{\tau} = W_{T-2} - V_{T-2} .
\end{aligned}
$$

To see this, substitute (5) into (4). The worker opts to leave iff

$$A_{T-2} + W_{T-2} - V_{T-2} > W_{T-2}$$

(6) or if

$$A_{T-2} > V_{T-2}$$

which is the efficiency condition.

Note also that if $A_{T-2} > V_{T-2}$, the worker chooses retirement at $T - 2$ over retirement at T. The second condition is redundant. Since $A_{T-2} > V_{T-2}$ implies $A_{T-1} > V_{T-1}$, the efficient pension plan already insures that inequality (3) holds as well. Since the efficient pension at $T - 1$ induced retirement at $T - 1$ whenever $A_{T-1} > V_{T-1}$, it is clear that retirement at $T - 2$ dominates retirement at $T - 1$.

This provides a general statement of the efficient pension:

$$(7) \quad P_{T-1} - \frac{P_{T-i+1}}{1+r} = W_{T-i} - V_{T-i}$$

or

$$(7') \quad S_{T-i} \sum_{\tau=0}^{K+i} \left(\frac{1}{1+r}\right)^{\tau} - \frac{1}{1+r} S_{\tau-i+1} \sum_{\tau=0}^{K+i-1} \left(\frac{1}{1+r}\right)^{\tau} = W_{T-i} - V_{T-i}$$

so

$$(8) \quad P_{T-i} = \sum_{\tau=1}^{i} [W_{T-\tau} - V_{T-\tau}] \left(\frac{1}{1+r}\right)^{i-\tau} + \frac{P_T}{(1+r)^i} .$$

The terminal value, P_T, is exogenous to this problem. It might be the optimal pension to prevent shirking in the final period before retirement or simply a rent-sharing parameter.

It is through equations (7) and (8) that we derive our results. If the wages of old workers exceed their marginal products, then the present value of the pension falls as the age of retirement rises (eq.(7)). Similarly, eq. (7) provides us with an estimate of the difference between W and V at each point in time because P_{T-i} and P_{T-i+1} are observed.

The case of postponed retirement is equivalent. Normal retirement is not special once we allow pension benefits to vary with the date of retirement. The date of "normal retirement" is likely to be the date of modal retirement. In almost all cases that age is 65 and corresponds to the start of social security payments. Since the social security earnings test causes the A(t) function to take a discrete jump upwards at age 65. Except for this detail, the analysis of postponed retirement is similar. The worker's choice is still reflected by (1) so all holds as above with a replacement of subscripts. If j is the number of years after "normal retirement" then retirement occurs iff:

$$(1') \quad A_{T+j} + S_{T+j} \sum_{\tau=0}^{K-j} \left(\frac{1}{1+r} \right)^t > W_{T+j} + \frac{S_{T+j+1}}{1+r} \sum_{t=0}^{K-(j+1)} \left(\frac{1}{1+r} \right)^t .$$

Eqs. (7), (7') and (8) follow correspondingly so that an estimate of W - V can be obtained for those years after T as well by examining the way in which pension benefits decline in late retirement.

Let us summarize this section. The pension which acts as severance pay reduces the true wage to V when we take into account the way that the pension value falls with experience. Since the pension is not paid if the separation is punishment for too little effort, incentives are maintained while efficient turnover is produced. Employers are willing to buy out of a long term contract if the wage rate exceeds VMP. The amount that employers are willing to pay reveals something about the difference between W and V. Pensions may act as a buyout. If the value of the pension declines with the age of retirement, this suggests that the pension plays the role of severance pay.

Less than Perfect Separation Efficiency

The model discussed earlier allowed V to be random and unknown by both parties. Under these circumstances, one instrument, in this case the pension stream P(t), is not sufficient to eliminate all inefficient separation. The reason is that when the firm uniquely knows the value of the worker to the firm, the only way to make that information useful is to give the firm some discretion over when work occurs. But to do this immeidately creates a problem. Since the firm is anxious to sever the worker whenever $V < W - S$. This leads to situations where $A < V < W - S$ so that a layoff occurs when a separation is inefficient.

The introduction of a second instrument can alleviate some of this difficulty. If different amounts of severance pay are paid depending upon who initiates the separation, some inefficient layoffs and quits can be eliminated. This raises two difficulties. First, it creates a situation where each side tries to induce the other to initiate the separation. Second, it generates inefficient retention as a bi-product. This occurs when $W - L < V < A < W - Q$, where Q is what is paid to the worker as severance pay if the worker initiates the separation and L is what is paid to the worker if the firm initiates the separation. If $L = Q$ this condition can never hold, but for $L > Q$, inefficient retention occurs. This is discussed in depth in Hall and Lazear (1982). It is also shown that it is never optimal to select $L < Q$ since this results in needless inefficient separations.

Perhaps because of these difficulties and those associated with determining who actually initiated the separation, pensions rarely vary with the identity of the initiating party.

Vesting

Vesting is an issue that always arises when pensions are discussed. This seems especially relevant when one of the arguments for incorporating a pension into the generalized compensation plan relates to incentives for increased effort or reduced turnover. It is sometimes suggested that non-vested pensions can reduce worker turnover whereas vested pensions cannot. The model in the previous section should make clear the point that "vesting" in and of itself has little meaning.

What vesting guarantees is that a worker is entitled to receive the currently accured benefits. But currently accrued benefits may be small indeed until the last few years before retirement. There are a number of reasons which all derive from the large number of degrees of freedom inherent in setting up a benefit formula. First, many benefit formulas d epend upon final salary or an average of salaries earned in the last few years before retirement. Since salary grows with age, and in an inflationary period, with chronological time, the benefits received by a worker who leaves the firm at age 30 may be much smaller than that received by the same worker who leaves at age 65. Second, since length of service affects benefits, formulas can be specified to make the accrual rate a convex function of years of service, placing a premium on long tenure. Third, as Bulow points out, a worker who is vested, but below the age at which early retirement benefits can be received, earns a promise of a pension at normal retirement age, not the benefits themselves. Because of the higher value of pensions taken upon early retirement, remaining with the firm at least until the age of early retirement election is generally lucrative.

In the same vein, the tendency of many plans to gear pension benefits to final salary is evidence for the incentive role of pensions. Most other rationalizations for pensions (discussed below)_ at best gear pensions to a lifetime average rather than to an average of final salaries. Since final salary can be adjusted to reflect worker effort, hours worked, and productivity, the multiplier effect on the pension value may provide significant incentives for workers to maintain effort and a high level of hours worked during those final years.

The Empirical Analysis:

Data

The data for this analysis were constructed using two sources; the Bankers' Trust Study of Corporate Pension Plans, 1975 and the Bankers' Trust 1980 Corporate Pension Plan Study. Each of these studies consists of a detailed verbal description of the pension plans of over 200 of the nation's largest corporations. The data sets apply to approximately 8 to 10 million workers and this comprises about one-fourth of the entire covered population.

Firms are not identified by name in the descriptions. However, a sufficient amount of detail is given about each firm so that it was possible to match firms up between the 1975 and 1980 samples. For example, the descriptions report the industry in which the firm produces, the date at which the pension plan was adopted and amended, and the number and types of employees covered by the plan. Screening on the basis of these and other criteria resulted in a longitudinal data set of 70 matched firms for the two years in addition to the two cross-sections of 200+ firms for each year.

The major empirical task was to covert the verbal descriptions into machine readable data. This required setting up a coding system that was specific enough to capture all of the essential detail associated with each plan. After that was done, it was necessary to write a program which calculates the present value of pension benefits at each age of retirement. A brief summary of that approach follows.

Pension benefit formulas assume three different types. The two most common fall under the rubric of defined benefit plans. A defined benefit plan specifies the pension flow as a fixed payment determined by some formula. The pattern plan awards the recipient a flat dollar amount per year worked upon retirement. The conventional plan calculates the pension benefit flow from a formula which depends upon years of service and some average salary. In contrast to the defined benefit plans are the defined contribution plans where the employer (or employee) contributes a specified amount each year during the worklife to a pension fund. The flow of pension benefits that the worker receives upon retirement is then a function of the market value of that fund. The defined contribution plan is much less frequently used than is either the pattern plan or conventional plan.

In order to test the theory exposited above, it is necessary to obtain estimates of the expected present value of pension benefits for each potential year of retirement. Specifically, the way in which pension values vary with age of retirement must be calculated. Some plans do not permit the individual to receive early retirement benefits or only permit early retirement up to a given number of years before the normal date. This means that in order to perform the necessary comparisons, sometimes plans had to be deleted from the relevant sample so that the entire series of retirement values would be valid.

It is important to realize that there are no real individuals in this sample. Since the data sets discussed above are descriptions of pension plans, the "individuals" below are hypothetical ones, created to perform the necessary simulation exercises. For each plan, for each of the two years, twelve "typical" employees were created, having all combinations of salary upon normal retirement of $9000, $15000, $25000 and $50000 and of tenure of 10, 20 and 30 years in 1975 and 20, 30 and 40 years in 1980. Much of the analysis below relates to these 2928 "individuals" from 244 plans in 1975 and to the 2712 "individuals" from the 226 plans in 1980. Since this simulation exercise was computationally expensive, a representative group was selected having salary of $25000 and tenure of 30 years upon normal retirement. Many of the comparative statics results below are derived from an examination of the individuals in this representative sample.

In order to calculate the expected present value of retirement at each age, two steps must be taken. First, for any hypothetical employee, the pension flow that he receives upon retirement in any given year must be calculated. Second, that flow must be converted into an expected present value by discounting it appropriately and by taking into account the age-specific death rates. Even the first step is far from straightforward.

Most plans have many restrictions on the maximum amount which can be accrued and many provide for minimum benefits. Additionally, a number reduce pension benefits by some fraction of the social security benefits to which some basic class is entitled. Moreover, a number of plans provide supplements for retirement before the social seucirty eligibility age. Sometimes these supplements relate directly to social security payments while at other times they depend upon the individual's salary or benefit level.

Other restrictions have to do with vesting requirements, with the maximum age at which the individual begins employment, with the minimum number of years served before the basic accrual or particular supplements are applicable. The accrual rate or flat dollar amount per year to which the individual is entitled is often a nonlinear function of tenure and salary and these kinks had to be programmed into the calculations.

In calculating retirement benefits, assumptions about wage growth for older workers are crucial. All plans which are based on salary compute some average of annual earnings over some relevant period. Therefore, it is nominal earnings growth that will affect the pension values. Elsewhere (Lazear 1981), I estimated earnings growth and found something that is well-known among labor economists: earnings growth is often negative in final years because hours of work decline (primarily for health reasons) in the final years before retirement. In the sample I examined based on CPS data from the mid-70's, the estimate of earnings growth for a particular synthetic cohort was anywhere from -2% to -13% depending upon how the sample was selected. Since more rapid wage growth will tend to make pension values increase with the age of retirement, selecting higher rates of wage growth tends to push the results against the theory of this paper. To be conservative, I selected a wage growth rate of zero for most of the analysis, and also recalculated pension benefits with a growth rate of positive 5%, well above that actually observed in the data.

Since all values are nominal, the nominal interest rate should be used as the discount factor. For most of the analysis, 10% was used, but 15% and 5% were also tried in order to ascertain the sensitivity of the results to the choice of discount rate. Although there were effects of varying the rates, none of the qualitative conclusions was altered.

Finally, in performing the actuarial correction, it was necessary to choose a life table. The 1975 life table for Americans was used for the 1975 sample and the 1978 table was used for the 1980 sample. Both were obtained from the U.S. Vital Statistics. The choice of table turns out to be the least crucial part of the analysis. Values do not vary greatly from year to year and discounting makes what small differences there are unimportant. What is important, however, is the possibility that early retirees do not have the same life expectancy of normal retirees. It is likely that many individuals retire early as the result of poor health and consequently have higher age-specific death rates. If this is true, then ignoring those differences will tend to bias the results in the direction of higher pension values for early retirees than is actually the case.

Findings

We start by discussing the data from the 1980 sample. Table 1 contains some descriptive statistics. Notice that there is a tremendous amount of variation in the present value of pension benefits even within each salary tenure group. For all "workers" taken together the standard deviation is as large as the mean. Within each salary-tenure group, the standard deviation is around half of the mean. A simple rule of thumb suggests that the mean pension value is about one-thirteenth of the product of final salary and tenure at retirement. It is somewhat more than this for very low salary workers and slightly less than this for high salary workers. This reflects both the provisions for maximum and especially minimum pension values which make the benefit structure progressive.

Before going further, it is interesting to compare this to the cross-section from 1975. Those data are presented in table 2. Although the average pension value if smaller in 1975 than 1980, this is the result of differences across groups. The 1975 data are constructed using hypothetical workers with 10, 20, and 30 years of tenure whereas the 1980 data are constructed using hypothetical workers with 20, 30, and 40 years of tenure. In fact, within each comparable salary-tenure group, the values for 1975 are significantly higher than those for 1980. We defer until later discussion of the reasons for this pattern. Another interesting difference is that the pattern is significantly less progressive in 1975 than in 1980. In 1975, the rule that the pension value equals about one-tenth of the product of final salary and tenure seems to hold across all salary levels with only slight traces of progressivity.

These findings do not suggest that pensions were larger in 1975 than they are in 1980. There are two main reasons: First, firms are not matched across years in these tables so that some of the difference may simply reflect random sample variations. Second, final salaries were substantially higher in 1980 than in 1975 so the relevant comparison is not necessarily the one that holds salary level constant.

In the context of the model, the most important results relate to the way in which pension values vary with the age of retirement. Table 3 selects those "individuals" in the 1980 sample who were permitted to retire at least ten years before the normal age and traces the mean present value of pensions for that group. EPV-10 refers to the expected present value of retiring ten years before the normal age, and similarly for EPV-9...EPV-1. EPV0 is the present value of retiring at normal age. The table is broken down by pension benefit formula type and then by salary and tenure level.

First examine the first panel which relates to conventional plans. Note that for all tenure-salary groups, the value of early retirement exceeds that of normal retirement (EPV-10 > EPV-9 > ...EPR-1 > EPV0). For ease of reading, ERAT(t) is defined as EPV(t)/EPR0 so that ERAT > 1 for all $t < 0$. This evidence supports the major prediction of the model: The expected present value of pension benefits decline as the age of retirement increases. Firms actually do "buy out" workers who retire early with higher pensions. As such, the interpretation that pensions act as severance pay is consistent with these results.

Further, ERAT-10 increases with tenure and salary. The buyout is larger not only in absolute terms, but also in relative terms for employees of longer service and of higher salaries. This is consistent with the interpretation that an upward-sloping age-earnings profile acts as an incentive device.

This is most easily seen by examining WVDIFF-10...WVDIFF-1. WVDIFF(t) is defined as $W_{T-t} - V_{T-t}$ and is calculated using the relationship shown in eq. (7). WVDIFF > 0 implies that the worker is being paid more than his marginal product and it results whenever $P_{T-i} > P_{T-i+1}$. WVDIFF-1/SALARY is the ratio of overpayment during the final year before retirement. That ratio goes from 1/6 for workers in the group with salary = 9000, tenure = 20 to 1/2 for workers in the group with salary = 50000, tenure = 40. This result has a nice interpretation.

First consider tenure: Individuals with shorter tenure are those who initiated their employment with the firm more recently. In the context of figure 2, those workers are less likely to have wages which exceed their marginal products. As the result, the buyout should be smaller. In fact, for individuals whose tenure is below $\bar{t}$ in figure 2, the buyout should actually be negative. (Although this occurs in a significant number of cases, it does not occur frequently enough to make the means display an increasing pattern.)

Second, high salary workers are those most likely to be performing jobs where wage incentive schemes are useful. Since those may be the jobs which are most difficult to monitor, a large penalty in the form of lost earnings is likely to be an integral part of the optimal compensation profile for these workers.

These points are also supported by consideration of panel 2 of table 3 which relates to pattern plan workers. It is also true that the general tendency is for the pension value to decline with age of retirement. But the decline does not seem to be as pronounced for these employees as for those with conventional plans. In fact, for those with only 20 years of experience at normal retirement, the means of WVDIFF-10, WVDIFF-9, and WVDIFF-8 are actually positive reflecting location in terms of figure 2 before $\bar{t}$. Since most of these workers are blue collar workers where more direct monitoring is possible, it is not surprising that the wages conform more to marginal product for these workers than for their higher level counterparts.

Finally, panel 3 reports defined contribution plans. We hesitate to draw any significant conclusions from this panel for two reasons. First, there are so few observations. Second, the Bankers' Trust studies do not really report the appropriate information for defined contribution plans so these calculations are more likely to be a function of interpretations made by them and by me. The one obvious feature is that definitionally, a defined contribution plan cannot decline in present value with age of retirement since the worker is always entitled to the present value of his contributions. Since contributions are never negative, that value must grow with age of retirement (although not necessarily at the same rate).

It is also true that pensions associated with retirement after the normal age should follow the same pattern of decline with age. Most of the sample was subject to mandatory retirement, but 13 conventional plans did allow the worker to elect to remain beyond the date of normal retirement. Table 4 presents information on those individuals. Since the pattern is similar across salary and tenure groups, we only report those calculations for a representative group with salary = 25000 and tenure = 30. The pattern of declining pension values is the same and smooth both before and after normal retirement.

It is interesting that this group for which there is no mandatory retirement have more steeply declining pensions than the group which does not distinguish on the basis of mandatory retirement. Compare ERAT(t) in table 4 with that for the corresponding group (salary = 30000, tenure = 30) in table 3 and it is clear that pensions decline more rapidly in table 4. This suggests that reductions in pensions are an alternative to mandatory retirement.[4]

The 1975 cross-section provides a basis for comparison. Results for the representative group are reported in table 5. In comparing these values with those for the appropriate groups in table 3, two things stand out. First, for pattern plans, the pensions are higher in the 1980 cross-section than in the 1975 cross-section while the reverse is true for conventional plans. Second, the decline in pension value with age of retirement is sharper in 1975 than in 1980 for pattern plans while the reverse is true for conventional plans. We defer attempts to explain these findings until after discussion of the matched sample since these differences may simply reflect random sampling variation across firms rather than trends over time.

The one obvious feature is again that the expected present value of pension benefits decline with increases in the age of retirement. Both years provide strong support of that conclusion. Again, this is consistent with the idea that pensions function as severance pay in an efficient compensation scheme.

There are some obvious institutional differences between the 1980 period and 1975. The most obvious is that the primary social security benefit against which many benefit formulas are offset, increased between 1975 and 1980. In order to determine the effect of social security on the calculations, the 1980 analysis was repeated, plugging in the 1975 primary social security formula. Since that value was lower than the 1980 value pensions increased. That is, some benefit formulas usually subtract some fraction of social security benefits from pension payments. Over time the amount subtracted has increased. Table 6, col. 2 presents the results for the representative group (salary = 25000, tenure = 30).

Pension benefits for 1980 in column 2 with the 1975 social security formula are about 7% higher than those using the 1980 formula for conventional plans. Although it is difficult to state the increase in primary social security benefits as a scalar, for the average worker that increase amounted to 68%. Thus the "elasticity" of the mean of pension benefits with respect to social security benefits is .1 . It is less than 1 primarily for two reasons: First, not all plans offset social security payments. Second, even those that do offset benefits do not do so fully. No pattern plans had social security offset provisions.

A general point is that because of the way that benefits are offset against social security primary benefits, any change in those benefits have major impacts on pensions and therefore on retirement and tax revenues. We do not explore those implications here.

The rate of inflation, wage growth, and nominal interest rates were different in 1980 than they were in 1975. In fact, one could argue that earnings growth of 5% per year for old workers and a nominal rate of interest of 15% are more reasonable. Column 3 of table 6 reports the results on the 1980 data using these assumptions.

Although the values change somewhat, the qualitative conclusions remain essentially unchanged. Pension values decline significantly with age. Incidentally, the reason that values are so much lower for conventional plans under the revised assumptions is that wage growth of 5% implies that an individual who retires ten years early has a salary of $15,348 rather than $250000. Since conventional plans are contingent upon final salary, benefits fall. At normal retirement, values are lower because of higher discount rates. Only the latter consideration affects pattern plans, causing their decline to be steepened substantially. The reasoning is not quite so straightforward, however, since these are means of highly nonlinear functions.[5]

Finally, as a last check on the robustness of the results, the analysis was repeated under the assumption that the nominal interest rate was only 5%. Col. 4 of table 6 contains those results.

With a nominal interest rate of 5%, the decline in pension value does not occur until about six years before normal retirement for the respresentative group. However, for groups with longer tenure (=40) the decline occurs throughout the period for conventional plans and during the last nine years for pattern plans. Moreover, in 1980, a nominal discount rate of 5% is surely well below the feasible range since short rates were above 20% and 30-year mortgage rate were around 16%. It is difficult to believe that 5% was the anticipated discount rate.

The Matched Sample:

Any of the differences noted above may have been the result of random differences in the cross-section rather than true time variations. To eliminate that source of confusion, 70 plans have been matched across the two years and this section reports findings based on that sample.

The major changes occured for pattern plans. In the matched sample, there was an increase in pension values of about 50% for normal retirement and over 100% for retirement ten years early. Since pattern plans are independent of final salary, it is not surprising that their values should increase in nominal terms over the period. However, two points are interesting. First, certainly for early retirement, but even for normal retirement the increase probably exceeds the increase in prices so that some of the gain is real, not nominal. Second, the decline in pension benefits with early retirement seems to have steepened sharply over the five year period, reflected in the 100+% gain for early and only 50+% gain for normal retirement.

Again this may reflect a substitution of pension reductions for mandatory retirement in light of changes in the Age Discrimination in Employmemnt Act. Of course, if pensions acted perfectly as an efficient severance pay device there would be no need for mandatory retirement at all. The inability to induce both efficient layoffs and quitting simultaneously provides a role for mandatory retirment and its restriction works in the direction of inducing more worker-initiated separations.

The results for conventional plans suggest a different pattern. Although differences are small, the benefits have, if anything, declined over time. This should not be taken at face value. More than this decline can be attributed to changes in social security. The maximum decline here is less than 5% and the mean decline due to social security was estimated at 7%. But more important is that conventional plans depend upon final salary which increases over time with inflation. This table makes comparisons based on equality of salary in nominal terms. But using the information in table 3, we can adjust the pension benefits to take this into account.

At tenure=30, an increase in salary from $25000 to $50,000 increases normal retirement value by $\frac{135,577 - 63,165}{63,165}$ or 114%. Therefore we can estimate that each dollar increase in final salary at tenure = 30 increases normal retirement pension value by $1.14. If the average final salary in these firms grew say 30% over the five year period, normal pension value would be expected to increase from $61,907 in 1975 to (61.232)(1.30)(1.14) = $90,745 in 1980. This would be an increase of 47%. This increase is about the same as that for pattern plans over the same period.

A similar exercise can be performed to correct the present value of retirement ten years early. Under the same assumptions, this results in an estimated pension value of 143,886 in 1980 based on the 1975 salary of $25,000. This is an increase of 40% so the steepening of the decline in pension values for pattern plans does not seem to be duplicated for conventional plans.[6]

Summarizing, pattern plans on average pay 50% more at normal retirement and 100% more on ten years early retirement than in 1975. Conventional plans are estimated to pay 47% on ten years early retirement than they did in 1975. In both years and under any reasonable assumptions, the expected present value of pensions tend to decline with increases in the age of retirement.

An Alternative Explanation and Other Issues:

Throughout the model it was assumed that workers were risk neutral. However, if workers are risk averse, then another explanation for the decline in pension value with age of retirement is available. When a worker begins employment, he may not know whether or not he will become ill and be forced to retire before the normal age. Since illness is a bad event, workers may wish to insure against that cnotingency by paying higher pensions to early retirees.

At some levels, this story is not inconsistent with the model. Eqs. (1)-(7) would have to be modified to take utility rather than alternative use of time into account. But the pension still acts as severance pay and induces workers to leave when appropriate. Appropriate carries a different meaning, however. Now, workers cannot be induced to leave if and only if the alternative use of time exceeds the value of the worker to the firm. To do so distroys the role of severance pay as an insurance device. This well-known result appears in many places,[7] but its point carries with it two implications for this analysis. First, severance pay does not induce efficient separation in the sense of a first best, perfect information optimum. Second, and as the result, the decline in pension value with retirement age is not an accurate measure of the difference between wage and marginal product. In fact, it overstates that value because some of the payment for early retirement is insurance.

There are a number of arguments which suggest that the insurance story is somewhat less plausible. First, there are other forms of insurance, some provided by the firm and other by a third party, which seem to be set up explicitly to handle these contingencies. Health insurance and more to the point disability insurance perform exactly those functions. It is not clear why a declining pension value should be required to play the same role.

Second, if pensions act as insurance, one would think that there would be no reason to prevent workers from taking them early. But most pension plans severly limit the age of early retirement. This is not true in general for health insurance and disability insurance. If pensions are an incentive device, it is easier to rationalize the unwillingness to pay pensions to early retirees.

Third, most pensions that are based on salary use the final few years salary as the basis of computation. If insurance were the motive, a lifetime average which more closely reflects expected permanent income would be appropriate. In fact, with insurance, a case could be made for a negative relationship between final salary and pension, given lifetime income, because of the inability of the older disabled worker to adjust to the fall in income.

Fourth, the decline in pension values is steepest for high income, white collar workers who have conventional rather than pattern plans. Yet one might argue that it is the blue collar workers who have both riskier jobs and fewer alternative forms of insurance. Although insurance may be a partial motive for pension values which decline with age of retirement, it seems difficult to believe that this is a major factor in the explanation.

Conclusion

The expected present value of pension benefits generally declines with the age of retirement. This phenomenon is easily explained if one views the pensions as a form of severance pay rather than as a tax-deferred savings account. Further, the real value of pension benefits have remained constant or increased in real terms over the period between 1975 and 1980 even though the same is probably not true for older workers' real earnings. Finally, there is some evidence to suggest that higher pensions for early retirement are being used as a substitute for mandatory retirement clauses in labor contracts.

Footnotes

[1]This analysis marries the models presented in Lazear (1981) and Hall and Lazear (1982).

[2]A more general formulation allows the severance payment to vary with the identity of the party who initiates the separation. Hall and Lazear consider this case and discuss its drawbacks.

[3]That the entire remaining stream must be examined is recognized in Fields and Mitchell (1981). Bulow (1981) also points out (as my calculations implicitly do) that the "true" current wage also includes the value of changing the pension as the result of working that period.

[4]See also Burkhauser and Quinn (1981).

[5]E.g., for some ages the mean rises even though no one plan ever rose. The nonlinearities makes some plans fall by less than others.

[6]There was only one matched defined contribution plan.

[7]To name a few, see Arnott and Stiglitz (1981), Azariadis (1980), Gree (1981), Green and Kalu (1981), Grossman and Hart (1981) and (1981b).

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Table 1

1980 Data
Moments of the Expected Present Value
of Normal Retirement Benefits
(Sample Selection Criterion: EPV-0 valid)

Group		Mean	Standard Deviation	N
All		55690	50636	2646
Salary	Tenure			
9000	20	17102	8063	218
9000	30	25209	11144	220
9000	40	32676	14610	221
15000	20	23054	10597	220
15000	30	34167	14100	220
15000	40	44020	18027	221
25000	20	37367	19140	221
25000	30	55353	26110	221
25000	40	70779	32897	221
50000	20	75730	44270	221
50000	30	111368	61755	221
50000	40	140551	77253	221

Table 2

1975 Data

Moments of Expected Present Value
of Normal Retirement Benefits
(Sample Criterion: EPV-0 valid)

Group		Mean	Standard Deviation	N
All		55690	50636	2646
Salary	Tenure			
9000	10	10624	3921	192
9000	20	20864	7700	194
9000	30	30403	11411	183
15000	10	16416	7008	194
15000	20	31359	14116	204
15000	30	47369	20118	186
25000	10	26125	13869	199
25000	20	51337	26328	206
25000	30	76989	39165	188
50000	10	50931	31338	205
50000	20	101462	60683	206
50000	30	151337	90222	188

Table 3

1980 Expected Present Value of Pension Benefits
Defined Benefit
Conventional Plans
(Sample: Valid EPV-10...EPV0)

Salary	9000	9000	9000	15000	15000	15000	25000	25000	25000	50000	50000	50000
Tenure	20	30	40	20	30	40	20	30	40	20	30	40
Variable												
EPV-10	27225	50845	73959	35384	66875	97232	55958	107585	158225	115633	226685	332604
EPV-9	26911	48451	69381	35391	64506	92318	56822	105111	151713	118342	222374	319890
EPV-8	26392	45905	64904	35116	61886	87459	57200	101951	144918	119778	216465	306211
EPV-7	25684	43266	60506	34603	59074	82620	57081	98212	137902	120120	209160	291814
EPV-6	24856	40687	56288	33945	56211	77814	56522	94213	130778	119398	201062	276943
EPV-5	23868	38216	52277	33162	53484	73241	55604	90176	123844	117706	192441	261907
EPV-4	22752	35594	48218	32058	50344	68345	54142	85524	116234	114845	182598	245945
EPV-3	21496	32993	44277	30634	47113	63512	52165	80656	108553	110988	172413	229942
EPV-2	20089	30311	40347	28890	43598	58377	49549	75143	100236	105770	160908	212544
EPV-1	18699	27785	36690	27146	40278	53594	46903	69863	92429	100288	149675	195920
EVP-0	17032	24839	31624	24846	36166	45962	43244	63165	79476	92555	135577	168913
ERAT-10	1.617	2.131	2.517	1.550	2.122	2.542	1.601	2.285	2.836	1.972	2.993	3.816
ERAT-9	1.609	2.038	2.372	1.553	2.041	2.407	1.619	2.212	2.694	1.996	2.887	3.609
ERAT-8	1.587	1.939	2.228	1.541	1.955	2.274	1.623	2.129	2.550	2.000	2.770	3.401
ERAT-7	1.552	1.835	2.085	1.519	1.865	2.143	1.612	2.039	2.406	1.985	2.644	3.194
ERAT-6	1.509	1.733	1.946	1.490	1.773	2.013	1.590	1.944	2.263	1.953	2.512	2.989
ERAT-5	1.453	1.636	1.815	1.456	1.686	1.891	1.557	1.850	2.126	1.908	2.378	2.789
ERAT-4	1.389	1.528	1.679	1.409	1.587	1.762	1.512	1.747	1.982	1.847	2.236	2.590
ERAT-3	1.317	1.421	1.547	1.349	1.485	1.636	1.456	1.641	1.840	1.776	2.094	2.395
ERAT-2	1.234	1.307	1.412	1.274	1.373	1.502	1.380	1.522	1.689	1.680	1.936	2.192

Table 3

1980 Expected Present Value of Pension Benefits
Defined Benefit
Conventional Plans (continued)
(Sample: Valid EPV-10...EPV0)

Salary	9000	9000	9000	15000	15000	15000	25000	25000	25000	50000	50000	50000
Tenure	20	30	40	20	30	40	20	30	40	20	30	40
Variable												
ERAT-1	1.151	1.201	1.287	1.198	1.268	1.377	1.303	1.408	1.549	1.581	1.784	2.000
ERAT-0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WVDIFF-10	121	922	1764	-2	913	1894	-332	953	2510	-1044	1661	4901
WVDIFF-9	220	1079	1898	116	1111	2060	-160	1340	2881	-609	2506	5801
WVDIFF-8	330	1231	2051	238	1311	2257	55	1744	3272	-159	3408	6716
WVDIFF-7	424	1323	2164	337	1469	2466	286	2052	3655	370	4155	7641
WVDIFF-6	557	1394	2264	441	1539	2581	518	2278	3914	955	4866	8476
WVDIFF-5	693	1628	2519	685	1949	3040	908	2888	4725	1776	6112	9910
WVDIFF-4	857	1776	2691	972	2206	3300	1350	3324	5245	2634	6956	10930
WVDIFF-3	1056	2015	2952	1310	2640	3857	1964	4141	6249	3920	8644	13071
WVDIFF-2	1148	2087	3022	1441	2743	3952	2187	4363	6451	4531	9282	13738
WVDIFF-1	1515	2678	4605	2090	3738	6938	3326	6089	11775	7029	12816	24551
NORMAL	2911	4267	5282	4759	6994	8679	7885	11608	14363	15783	23258	28787
N	133	133	134	140	141	144	141	144	144	143	144	144

Table 3 (cont.)

Defined Contribution
Pattern Plans
(Benefits are Independent of Final Salary)

Tenure Variable	20	30	40
EPV-10	20450	40651	64349
EPV-9	21085	40103	61913
EPV-8	21513	39296	59276
EPV-7	21704	38262	56477
EPV-6	21667	37031	53554
EPV-5	21454	36164	51868
EPV-4	21053	34485	48489
EPV-3	20498	32716	45117
EPV-2	19730	30752	41577
EPV-1	18863	28767	38430
EPV-0	17982	26876	35361
ERAT-10	1.113	1.491	1.810
ERAT-9	1.150	1.473	1.743
ERAT-8	1.176	1.446	1.670
ERAT-7	1.189	1.410	1.592
ERAT-6	1.190	1.367	1.510
ERAT-5	1.180	1.334	1.461
ERAT-4	1.161	1.274	1.367
ERAT-3	1.132	1.210	1.272
ERAT-2	1.092	1.140	1.173
ERAT-1	1.047	1.068	1.085
ERAT-0	1.000	1.000	1.000

Table 3 (cont.)

Defined Contribution
Pattern Plans
(Benefits are Independent of Final Salary)

Tenure Variable	20	30	40
WVDIFF-10	-244	211	939
WVDIFF-9	-181	342	1118
WVDIFF-8	-89	482	1305
WVDIFF-7	13	631	1500
WVDIFF-6	126	489	951
WVDIFF-5	249	1042	2098
WVDIFF-4	378	1208	2303
WVDIFF-3	577	1475	2659
WVDIFF-2	716	1640	2600
WVDIFF-1	801	1718	2789
NORMAL	2766	4123	5421
N	38	38	38

Table 3 (cont.)

1980 Expected Present Value of Pension Benefits
Defined Contribution
Conventional Plans
(Sample: Valid EPV-10...EPV0)

Salary	9000	9000	9000	15000	15000	15000	25000	25000	25000	50000	50000	50000
Tenure	. 20	30	40	20	30	40	20	30	40	20	30	40
Variable												
EPV-10	12673	25346	38019	18342	36685	55028	79855	92130	104405	110490	130873	151256
EPV-9	14915	28475	42035	21588	41214	60840	74546	87680	103924	104846	127313	150007
EPV-8	17256	31636	46016	24975	45789	66602	70081	84009	112287	100447	124857	156816
EPV-7	19670	34800	49931	28469	50369	72269	66364	83964	120471	97148	123350	170478
EPV-6	22131	37940	53749	32033	54913	77794	63310	90640	128407	94808	129091	183789
EPV-5	24615	41025	57435	35627	59379	83130	60836	97162	136028	93295	139642	196637
EPV-4	26280	42705	59130	38037	61810	85584	62885	102189	141492	91610	148476	206947
EPV-3	27865	44257	60649	40332	64056	87781	67321	106923	146524	98781	156887	216587
EPV-2	28500	44334	60168	41251	64168	87086	70731	110026	149322	105018	163361	223525
EPV-1	28995	44255	59516	41966	64054	86142	73865	112742	151618	110929	169314	229722
EPV-0	29344	44016	58689	42472	63708	84944	76686	115029	153372	116434	174652	235071
ERAT-10	0.431	0.575	0.647	0.431	0.575	0.647	0.916	0.754	0.673	0.760	0.654	0.597
ERAT-9	0.508	0.646	0.716	0.508	0.646	0.716	0.876	0.738	0.685	0.747	0.661	0.614
ERAT-8	0.588	0.718	0.784	0.588	0.718	0.784	0.846	0.727	0.742	0.744	0.673	0.655
ERAT-7	0.670	0.790	0.850	0.670	0.790	0.850	0.825	0.742	0.798	0.748	0.689	0.717
ERAT-6	0.754	0.861	0.915	0.754	0.861	0.915	0.810	0.803	0.853	0.759	0.734	0.777
ERAT-5	0.838	0.932	0.978	0.838	0.932	0.978	0.802	0.862	0.905	0.775	0.798	0.835
ERAT-4	0.895	0.970	1.007	0.895	0.970	1.007	0.835	0.905	0.940	0.786	0.850	0.880
ERAT-3	0.949	1.005	1.033	0.949	1.005	1.033	0.892	0.945	0.971	0.849	0.899	0.923
ERAT-2	0.971	1.007	1.025	0.971	1.007	1.025	0.932	0.966	0.984	0.902	0.936	0.952

Table3 (cont.)

1980 Expected Present Value of Pension Benefits
Defined Contribution
Conventional Plans
(Sample: Valid EPV-10...EPV0)

Salary	9000	9000	9000	15000	15000	15000	25000	25000	25000	50000	50000	50000
Tenure	20	30	40	20	30	40	20	30	40	20	30	40
Variable												
ERAT-1	0.988	1.005	1.014	0.988	1.005	1.014	0.968	0.985	0.993	0.953	0.969	0.977
ERAT-0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
WVDIFF-10	-864	-1206	-1548	-1251	-1745	-2240	2046	1715	185	2175	1372	481
WVDIFF-9	-992	-1340	-1688	-1436	-1940	-2443	1893	1557	-3546	1865	1041	-2887
WVDIFF-8	-1126	-1476	-1826	-1629	-2136	-2643	1733	20	-3817	1539	702	-6373
WVDIFF-7	-1263	-1611	-1958	-1828	-2331	-2835	1567	-3425	-4072	1200	-2945	-6830
WVDIFF-6	-1401	-1741	-2081	-2028	-2520	-3012	1396	-3681	-4301	853	-5956	-7252
WVDIFF-5	-1033	-1043	-1052	-1496	-1509	-1523	-1272	-3121	-3393	1046	-5484	-6401
WVDIFF-4	-1082	-1059	-1036	-1567	-1534	-1500	-3030	-3233	-3436	-4897	-5745	-6583
WVDIFF-3	-477	-58	360	-690	-84	522	-2561	-2331	-2101	-4686	-4864	-5213
WVDIFF-2	-408	65	539	-591	94	780	-2590	-2244	-1898	-4885	-4919	-5121
WVDIFF-1	-317	217	752	-459	314	1088	-2564	-2079	-1594	-5004	-4852	-4863
NORMAL	4560	6840	9120	6600	9900	13200	11916	17875	23833	18777	28166	37555
N	1	1	1	1	1	1	2	2	2	3	3	3

Table 4

1980 Expected Present Value of Pension Benefits
Defined Benefit
Conventional Plans
(Sample: Valid EPV-10 through EPV+10)

Salary = 25000, Tenure = 30

Variable	
EPV-10	172152
EPV-9	164207
EPV-8	155953
EPV-7	147497
EPV-6	139459
EPV-5	131337
EPV-4	123435
EPV-3	115517
EPV-2	107090
EPV-1	98892
EPV-0	90864
EPV+1	81671
EPV+2	73155
EPV+3	65256
EPV+4	57955
EPV+5	51232
EPV+6	45070
EPV+7	39446
EPV+8	34337
EPV+9	29718
EPV+10	25562

Table 4 (cont.)

ERAT-10	1.837
ERAT-9	1.755
ERAT-8	1.670
ERAT-7	1.583
ERAT-6	1.499
ERAT-5	1.415
ERAT-4	1.335
ERAT-3	1.253
ERAT-2	1.167
ERAT-1	1.083
ERAT-0	1.000
ERAT+1	0.899
ERAT+2	0.805
ERAT+3	0.719
ERAT+4	0.639
ERAT+5	0.565
ERAT+6	0.497
ERAT+7	0.435
ERAT+8	0.379
ERAT+9	0.328
ERAT+10	0.282

N = 13

Table 5

1975 Expected Present Value of Pension Benefits
(Sample: Valid EPV-10...EPV0)

Variable	Group Defined Benefits		Defined Contribution
	Conventional	Pattern	
EPV-10	125113	33779	62454
EPV-9	120062	32585	62016
EPV-8	114846	31215	62273
EPV-7	109373	29698	64556
EPV-6	103770	28059	67358
EPV-5	98161	26831	70045
EPV-4	92247	25215	72904
EPV-3	86338	23692	75589
EPV-2	80283	22017	77623
EPV-1	74422	20478	79395
EPV-0	65962	19007	80441
ERAT-10	2.052	1.764	.782
ERAT-9	1.990	1.703	.779
ERAT-8	1.922	1.633	.785
ERAT-7	1.848	1.555	.812
ERAT-6	1.768	1.471	.846
ERAT-5	1.686	1.407	.878
ERAT-4	1.596	1.323	.913
ERAT-3	1.505	1.244	.945
ERAT-2	1.409	1.157	.969
ERAT-1	1.314	1.077	.989
N =	127	42	11

Table 6

1980 Expected Present Value of Pensions
Comparative Analysis
Salary = 25000, Tenure = 30
(Sample: Valid EPV-10...EPV0)

Criterion →	Defined Benefit Pattern Plan			
	(1) Wage Growth = 0 r = .1 Soc. Sec. = 1980	(2) Wage Growth = 0 r = .1 Soc. Sec. = 1975	(3) Wage Growth = 5% r = .15 Soc. Sec. = 1980	(4) Wage Growth = 0 r = .05 Soc. Sec. = 1980
Variable ↓				
EPV-10	40651	40651	48189	37328
EPV-9	40103	40103	45650	38291
EPV-8	39296	39296	42961	39011
EPV-7	38262	38262	40178	39489
EPV-6	37031	37031	37353	39728
EPV-5	36164	36164	35134	40201
EPV-4	34485	34485	32180	39859
EPV-3	32716	32716	29326	39314
EPV-2	30752	30752	26481	38447
EPV-1	28767	28767	23797	37358
EPV-0	26876	26876	21379	36247
ERAT-10	1.491	1.491	2.222	1.015
ERAT-9	1.473	1.473	2.109	1.043
ERAT-8	1.446	1.446	1.988	1.064
ERAT-7	1.410	1.410	1.862	1.079
ERAT-6	1.367	1.367	1.733	1.087
ERAT-5	1.334	1.334	1.629	1.100
ERAT-4	1.274	1.274	1.494	1.092
ERAT-3	1.210	1.210	1.364	1.079
ERAT-2	1.140	1.140	1.234	1.056
ERAT-1	1.068	1.068	1.111	1.028
ERAT-0	1.000	1.000	1.000	1.000

N = 38

Table 6

1980 Expected Present Value of Pensions
Comparative Analysis
Salary = 25000, Tenure = 30
(Sample: Valid EPV-10...EPV0)

Criterion → / Variable ↓	Defined Benefit Conventional Plan (1) Wage Growth = 0, r = .1, Soc. Sec. = 1980	(2) Wage Growth = 0, r = .1, Soc. Sec. = 1975	(3) Wage Growth = 5%, r = .15, Soc. Sec. = 1980	(4) Wage Growth = 0, r = .05, Soc. Sec. = 1980
EPV-10	107585	115384	75317	98194
EPV-9	10511	112624	72110	99791
EPV-8	101951	109222	68908	100673
EPV-7	98212	105190	65751	100866
EPV-6	94213	100945	62739	100629
EPV-5	90176	96537	60051	100129
EPV-4	85524	91512	56973	98769
EPV-3	80656	86313	53779	96880
EPV-2	75143	80482	50347	93876
EPV-1	69863	74810	47206	90727
EPV-0	63165	67749	43452	85261
ERAT-10	2.285	2.297	2.197	1.548
ERAT-9	2.212	2.221	2.070	1.558
ERAT-8	2.129	2.137	1.949	1.559
ERAT-7	2.039	2.045	1.835	1.553
ERAT-6	1.944	1.949	1.728	1.540
ERAT-5	1.850	1.852	1.632	1.523
ERAT-4	1.747	1.748	1.531	1.496
ERAT-3	1.641	1.641	1.431	1.461
ERAT-2	1.522	1.523	1.326	1.409
ERAT-1	1.408	1.408	1.231	1.355
ERAT-0	1.000	1.000	1.000	1.000
N = 144	144	144	137	144

Table 7

Matched Data: Pension Values
(Sample: Valid EPV-10...EPV0)
Salary = 25000, Tenure = 30

Years Before Normal Retirement	EPV80	EPV75	EPV80-EPV75
Conventional Plans			
EPV-10	99981	102380	-2399
EPV-9	97554	98815	-1261
EPV-8	94583	94874	-290
EPV-7	91241	92823	-1581
EPV-6	87617	88272	-654
EPV-5	84049	86952	-2902
EPV-4	79727	82376	-2649
EPV-3	75201	79034	-3832
EPV-2	70260	73616	-3355
EPV-1	65715	68334	-2618
EPV-0	61232	61907	-675
N = 19			
Pattern Plans			
EPV-10	43097	20199	22898
EPV-9	42476	20179	22296
EPV-8	41583	23283	18300
EPV-7	40451	22842	17609
EPV-6	39112	22261	16851
EPV-5	38660	25111	13548
EPV-4	36737	23818	12918
EPV-3	34729	22724	12005
EPV-2	32505	21272	11233
EPV-1	30274	19925	10349
EPV-0			
N =			