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3 Pensions as Severance Pay

Edward P. Lazear

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 because 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 Since nothing is withdrawn explicitly from the account until retirement, the value of pension benefits should be strictly increasing with age of retirement under the

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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 ensure 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 Pension 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 1982).

The major findings are:

1. Although severance pay does not always guarantee efficient labor mobility, appropriately 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 paid 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 10 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 0 and work, if it occurs at all, takes place during period 1. 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 1 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 3.1. 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 deter-

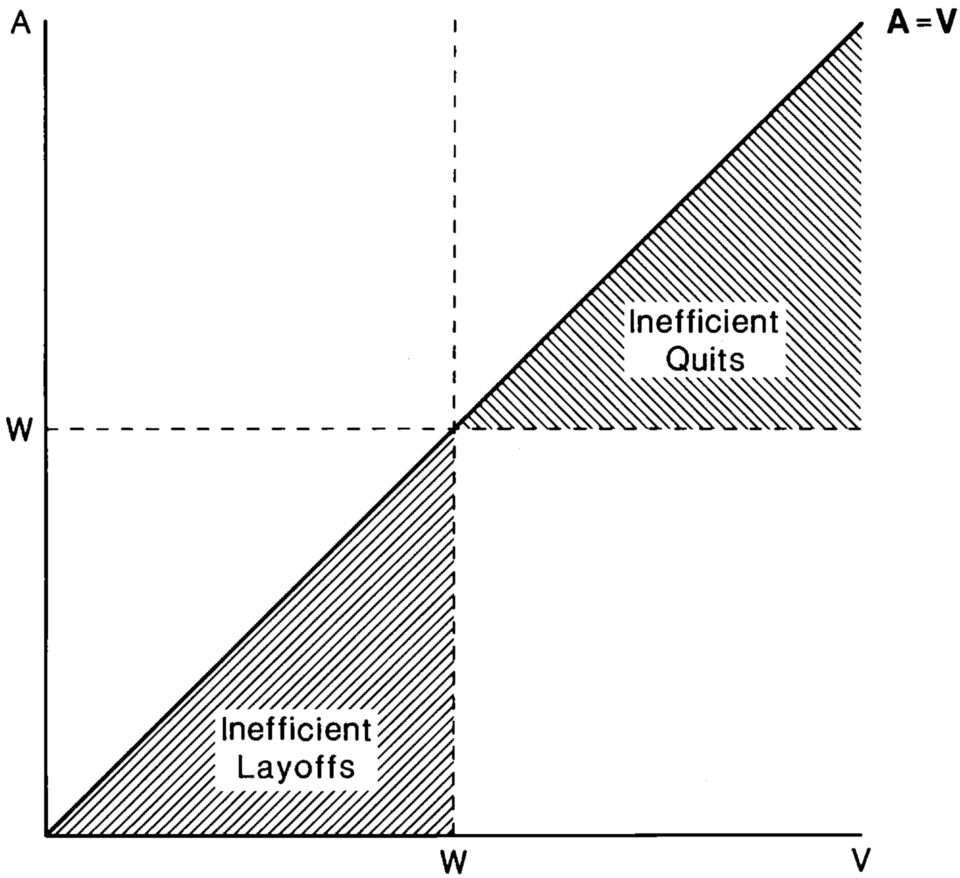

Fig. 3.1

mine a separation and he has no incentive to take into account the fact that although 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 $A > V$. Thus 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 value 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 agreement 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 separation occurs.[2] The worker quits if and only if $A + S > W$ or if and only if $A > W - S$. The firm lays the worker off if and only if $W - V > S$ or if and only if $V > W - S$.

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 not feasible or is undesirable 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 desirable that the way in which 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 if and only if $A > \bar{V}$. 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 $W - S = \bar{V}$ because W is free to vary. Thus, the rent-sharing arrangement pays S and the additional degree of freedom provided by W ensures separation efficiency.

A pension can be thought 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; 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 on 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 work lives. But a pension awarded only on 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 on 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 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 3.2. 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

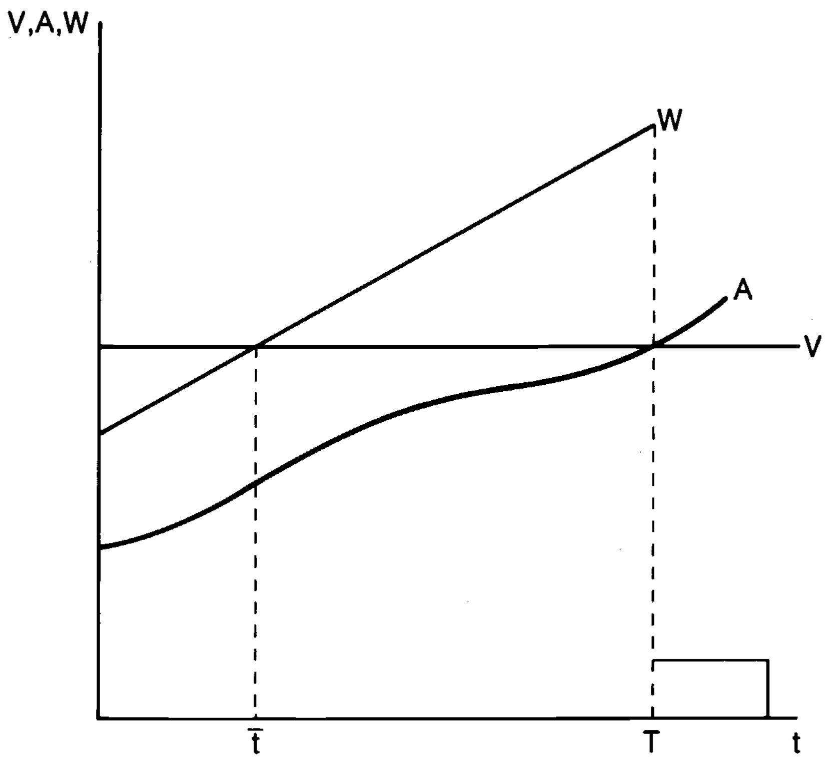

Fig. 3.2

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

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) if and only if $A_{T-1} > V_{T-1}$. If $P_{T-1} \equiv S_{T-1} \sum_{\tau=0}^{K+1} 1/(1+r)^\tau$ and $P_T \equiv S_T \sum_{\tau=0}^{K} 1/(1+r)^\tau$, then choose P_T and P_{T-1} so that

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

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

$$A_{T-1} + W_{T-1} - V_{T-1} > W_{T-1}$$

or

$$A_{T-1} > V_{T-1}. \tag{3}$$

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

Now consider that 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 $T-1$ if and only if

$$A_{T-2} + \frac{E_{T-2}(A_{T-1})}{1+r} + S_{T-2} \sum_{\tau=0}^{K+2} \frac{1}{(1+r)^\tau} > W_{T-2} + \frac{E_{T-2}(A_{T-1})}{1+r} + \frac{S_{T-1}}{1+r} \sum_{\tau=0}^{K+1} \frac{1}{(1+r)^\tau}, \tag{4}$$

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. if and only if $A_{T-2} > V_{T-2}$ (which by assumption, implies $A_{T-1} > V_{T-1}$). An efficient pension plan sets

$$P_{T-2} - \frac{1}{(1+r)} P_{T-1} = W_{T-2} - V_{T-2},$$

or

$$S_{T-2} \sum_{\tau=0}^{K+2} \left(\frac{1}{1+r}\right)^{\tau} - \frac{S_{T-1}}{1+r} \sum_{\tau=0}^{K+1} \left(\frac{1}{1+r}\right)^{\tau} = W_{T-2} - V_{T-2}. \tag{5}$$

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

$$A_{T-2} + W_{T-2} - V_{T-2} > W_{T-2} \tag{6}$$

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 ensures 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:

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

or

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

so

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

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, equation (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 because the social security earnings test causes the $A(t)$ function to take a discrete jump upward 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 if and only if

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

Equations (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.

3.1.1 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 immediately creates a problem, because 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 biproduct. 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 $L < Q$ because 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.

3.1.2 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 nonvested pensions can reduce worker turnover whereas vested pensions cannot. The model in the previous section should make clear that "vesting" in and of itself has little meaning.

Vesting guarantees that a worker is entitled to receive currently accrued 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 depend upon final salary or an average of salaries earned in the last few years before retirement. Because 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 those received by the same worker if he leaves at age 65. Second, because 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 on 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.

3.2 The Empirical Analysis

3.2.1 Data

The data for this analysis were constructed using two sources: the Bankers' Trust *Study of Corporate Pension Plans 1975* and the Bankers' Trust *Corporate Pension Plan Study (1980)*. 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 8–10 million workers, and this comprises about one-fourth of the entire covered population.

Firms are not identified by name in the descriptions. However, enough detail is given about each firm so that it is possible to match up firms in 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 convert 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. It was then 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 a flat dollar amount per year worked to the recipient on retirement. The conventional plan calculates the pension benefit flow from a formula which depends on years of service and some average salary. In contrast to the defined-benefit plans are the defined-contribution plans in which the employer (or employee) contributes a specified amount each year during the work life 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 the 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, 12 "typical" employees were created, having all combinations of salary on normal retirement of $9,000, $15,000, $25,000 and $50,000 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 2,928 "individuals" from 244 plans in 1975 and to the 2,712 "individuals" from the 226 plans in 1980. Because this simulation exercise was computationally expensive, a representative group was selected having salary of $25,000 and tenure of 30 years on 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 on 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 security eligibility age. Sometimes these supplements relate directly to social security payments; at other times they depend on 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, and 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 1970s, the estimate of earnings growth for a particular synthetic cohort was anywhere from −2% to −13% depending on how the sample was selected. Because 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 chapter. 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 varying the rates had some effects, it did not alter the qualitative conclusions.

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.

3.2.2 Findings

We start by discussing the data from the 1980 sample. Table 3.1 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 the provisions for both maximum and minimum pension values which make the benefit structure progressive.

Table 3.1 **1980 Data: Moments of the Expected Present Value of Normal Retirement Benefits (Sample Selection Criterion: EPV – 0 Valid)**

Salary ($)	Tenure (Years)	Mean	Standard Deviation	*N*
9,000	20	17,102	8,063	218
9,000	30	25,209	11,144	220
9,000	40	32,676	14,610	221
15,000	20	23,054	10,597	220
15,000	30	34,167	14,100	220
15,000	40	44,020	18,027	221
25,000	20	37,367	19,140	221
25,000	30	55,353	26,110	221
25,000	40	70,779	32,897	221
50,000	20	75,730	44,270	221
50,000	30	111,368	61,755	221
50,000	40	140,551	77,253	221
All		55,690	50,636	2,646

Before going further, it is interesting to compare this to the cross section from 1975. Those data are presented in table 3.2. Although the average pension value is smaller in 1975 than in 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

Table 3.2 **1975 Data: Moments of Expected Present Value of Normal Retirement Benefits (Sample Criterion: EPV – 0 Valid)**

Salary ($)	Tenure (Years)	Mean	Standard Deviation	*N*
9,000	10	10,624	3,921	192
9,000	20	20,864	7,700	194
9,000	30	30,403	11,411	183
15,000	10	16,416	7,008	194
15,000	20	31,359	14,116	204
15,000	30	47,369	20,118	186
25,000	10	26,125	13,869	199
25,000	20	51,337	26,328	206
25,000	30	76,989	39,165	188
50,000	10	50,931	31,338	205
50,000	20	101,462	60,683	206
50,000	30	151,337	90,222	188
All		55,690	50,636	2,646

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 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. Tables 3.3–3.5 select those "individuals" in the 1980 sample who were permitted to retire at least 10 years before the normal age and trace the mean present value of pensions for that group. EPV – 10 refers to the expected present value of retiring 10 years before the normal age, and similarly for EPV – 9 . . . EPV – 1. EPV – 0 is the present value of retiring at normal age. The tables are broken down by pension benefit formula type and then by salary and tenure level.

First examine table 3.3, 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 > EPV – 0). 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 declines 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 buy-out 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 equation (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 = 9,000, tenure = 20 to 1/2 for workers in the group with salary = 50,000, tenure = 40. This result has a nice interpretation.

Table 3.3 **1980 Expected Present Value of Pension Benefits: Defined-Benefit Conventional Plans (Sample: Valid EPV – 10 . . . EPV – 0)**

	Final Salary $9,000			Final Salary $15,000		
Variable	20-Year Tenure	30-Year Tenure	40-Year Tenure	20-Year Tenure	30-Year Tenure	40-Year Tenure
EPV – 10	27,225	50,845	73,959	35,384	66,875	97,232
EPV – 9	26,911	48,451	69,381	35,391	64,506	92,318
EPV – 8	26,392	45,905	64,904	35,116	61,886	87,459
EPV – 7	25,684	43,266	60,506	34,603	59,074	83,620
EPV – 6	24,856	40,687	56,288	33,945	56,211	77,814
EPV – 5	23,868	38,216	52,277	33,162	53,484	73,241
EPV – 4	22,752	35,594	48,218	32,058	50,344	68,345
EPV – 3	21,496	32,993	44,277	30,634	47,113	63,512
EPV – 2	20,089	30,311	40,347	28,890	43,598	58,377
EPV – 1	18,699	27,785	36,690	27,146	40,278	53,594
EPV – 0	17,032	24,839	31,624	24,846	36,166	45,962
ERAT – 10	1.617	2.131	2.517	1.550	2.122	2.542
ERAT – 9	1.609	2.038	2.372	1.553	2.041	2.407
ERAT – 8	1.587	1.939	2.228	1.541	1.955	2.274
ERAT – 7	1.552	1.835	2.085	1.519	1.865	2.143
ERAT – 6	1.509	1.733	1.946	1.490	1.773	2.013
ERAT – 5	1.453	1.636	1.815	1.456	1.686	1.891
ERAT – 4	1.389	1.528	1.679	1.409	1.587	1.762
ERAT – 3	1.317	1.421	1.547	1.349	1.485	1.636
ERAT – 2	1.234	1.307	1.412	1.274	1.373	1.502
ERAT – 1	1.151	1.201	1.287	1.198	1.268	1.377
ERAT – 0	1.000	1.000	1.000	1.000	1.000	1.000
WVDIFF – 10	121	922	1,764	–2	913	1,894
WVDIFF – 9	220	1,079	1,898	116	1,111	2,060
WVDIFF – 8	330	1,231	2,051	238	1,311	2,257
WVDIFF – 7	424	1,323	2,164	337	1,469	2,466
WVDIFF – 6	557	1,394	2,264	441	1,539	2,581
WVDIFF – 5	693	1,628	2,519	685	1,949	3,040
WVDIFF – 4	857	1,776	2,691	972	2,206	3,300
WVDIFF – 3	1,056	2,015	2,952	1,310	2,640	3,857
WVDIFF – 2	1,148	2,087	3,022	1,441	2,743	3,952
WVDIFF – 1	1,515	2,678	4,605	2,090	3,738	6,938
NORMAL	2,911	4,267	5,282	4,759	6,994	8,679
N	133	133	134	140	141	144

First consider tenure: Individuals with shorter tenure are those who initiated their employment with the firm more recently. In the context of figure 3.2, those workers are less likely to have wages which exceed their marginal products. As the result, the buy-out should be smaller. In fact, for individuals whose tenure is below $\bar{T}$ in figure 3.2, the buy-out should

Final Salary $25,000			Final Salary $50,000		
20-Year Tenure	30-Year Tenure	40-Year Tenure	20-Year Tenure	30-Year Tenure	40-Year Tenure
55,958	107,585	158,225	115,633	226,685	332,604
56,822	105,111	151,713	118,342	222,374	319,890
57,200	101,951	144,918	119,778	216,465	306,211
57,081	98,212	137,902	120,120	209,160	291,814
56,522	94,213	130,778	119,398	201,062	276,943
55,604	90,176	123,844	117,706	192,441	261,907
54,142	85,524	116,234	114,845	182,598	245,945
52,165	80,656	108,553	110,988	172,413	229,942
49,549	75,143	100,236	105,770	160,908	212,544
46,903	69,863	92,429	100,288	149,675	195,920
43,244	63,165	79,476	92,555	135,577	168,913
1.601	2.285	2.836	1.972	2.993	3.816
1.619	2.212	2.694	1.996	2.887	3.609
1.623	2.129	2.550	2.000	2.770	3.401
1.612	2.039	2.406	1.985	2.644	3.194
1.590	1.944	2.263	1.953	2.512	2.989
1.557	1.850	2.126	1.908	2.378	2.789
1.512	1.747	1.982	1.847	2.236	2.590
1.456	1.641	1.840	1.776	2.094	2.395
1.380	1.522	1.689	1.680	1.936	2.192
1.303	1.408	1.549	1.581	1.784	2.000
1.000	1.000	1.000	1.000	1.000	1.000
−332	953	2,510	−1,044	1,661	4,901
−160	1,340	2,881	−609	2,506	5,801
55	1,744	3,272	−159	3,408	6,716
286	2,052	3,655	370	4,155	7,641
518	2,278	3,914	955	4,866	8,476
908	2,888	4,725	1,776	6,112	9,910
1,350	3,324	5,245	2,634	6,956	10,930
1,964	4,141	6,249	3,920	8,644	13,071
2,187	4,363	6,451	4,531	9,282	13,738
3,326	6,089	11,775	7,029	12,816	24,551
7,885	11,608	14,363	15,783	23,258	28,787
141	144	144	143	144	144

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

Table 3.4 1980 Expected Value of Pension Benefits: Defined-Contribution Pattern Plans (Benefits are Independent of Final Salary)

Variable	20-Year Tenure	30-Year Tenure	40-Year Tenure
EPV−10	20,450	40,651	64,349
EPV−9	21,085	40,103	61,913
EPV−8	21,513	39,296	59,276
EPV−7	21,704	38,262	56,477
EPV−6	21,667	37,031	53,554
EPV−5	21,454	36,164	51,868
EPV−4	21,053	34,485	48,489
EPV−3	20,498	32,716	45,117
EPV−2	19,730	30,752	41,577
EPV−1	18,863	28,767	38,430
EPV−0	17,982	26,876	35,361
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
WVDIFF−10	−244	211	939
WVDIFF−9	−181	342	1,118
WVDIFF−8	−89	482	1,305
WVDIFF−7	13	631	1,500
WVDIFF−6	126	489	951
WVDIFF−5	249	1,042	2,098
WVDIFF−4	378	1,208	2,303
WVDIFF−3	577	1,475	2,659
WVDIFF−2	716	1,640	2,600
WVDIFF−1	801	1,718	2,789
NORMAL	2,766	4,123	5,421
N	38	38	38

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 table 3.4, 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 3.2 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, table 3.5 reports defined-contribution plans. We hesitate to draw any significant conclusions from this table 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 because 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 3.6 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 = 25,000 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 has more steeply declining pensions than the group which does not distinguish on the basis of mandatory retirement. Compare ERAT(t) in table 3.6 with that for the corresponding group (salary = 30,000, tenure = 30) in tables 3.3–3.5 and it is clear that pensions decline more rapidly in table 3.6. 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 3.7. In comparing these values with those for the appropriate groups in tables 3.3–3.5 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 because these differences may simply reflect random sampling variation across firms rather than trends over time.

Table 3.5 **1980 Expected Present Value of Pension Benefits: Defined-Contribution Conventional Plans (Sample: Valid EPV – 10 . . . EPV – 0)**

	Final Salary $9,000			Final Salary $15,000		
Variable	20-Year Tenure	30-Year Tenure	40-Year Tenure	20-Year Tenure	30-Year Tenure	40-Year Tenure
EPV – 10	12,673	25,346	38,019	18,342	36,685	55,028
EPV – 9	14,915	28,475	42,035	21,588	41,214	60,840
EPV – 8	17,256	31,636	46,016	24,975	45,789	66,602
EPV – 7	19,670	34,800	49,931	28,469	50,369	72,269
EPV – 6	22,131	37,940	53,749	32,033	54,913	77,794
EPV – 5	24,615	41,025	57,435	35,627	59,379	83,130
EPV – 4	26,280	42,705	59,130	38,037	61,810	85,584
EPV – 3	27,865	44,257	60,649	40,332	64,056	87,781
EPV – 2	28,500	44,334	60,168	41,251	64,168	87,086
EPV – 1	28,995	44,255	59,516	41,966	64,054	86,142
EPV – 0	29,344	44,016	58,689	42,472	63,708	84,944
ERAT – 10	0.431	0.575	0.647	0.431	0.575	0.647
ERAT – 9	0.508	0.646	0.716	0.508	0.646	0.716
ERAT – 8	0.588	0.718	0.784	0.588	0.718	0.784
ERAT – 7	0.670	0.790	0.850	0.670	0.790	0.850
ERAT – 6	0.754	0.861	0.915	0.754	0.861	0.915
ERAT – 5	0.838	0.932	0.978	0.838	0.932	0.978
ERAT – 4	0.895	0.970	1.007	0.895	0.970	1.007
ERAT – 3	0.949	1.005	1.033	0.949	1.005	1.033
ERAT – 2	0.971	1.007	1.025	0.971	1.007	1.025
ERAT – 1	0.988	1.005	1.014	0.988	1.005	1.014
ERAT – 0	1.000	1.000	1.000	1.000	1.000	1.000
WVDIFF – 10	–864	–1,206	–1,548	–1,251	–1,745	–2,240
WVDIFF – 9	–992	–1,340	–1,688	–1,436	–1,940	–2,443
WVDIFF – 8	–1,126	–1,476	–1,826	–1,629	–2,136	–2,643
WVDIFF – 7	–1,263	–1,611	–1,958	–1,828	–2,331	–2,835
WVDIFF – 6	–1,401	–1,741	–2,081	–2,028	–2,520	–3,012
WVDIFF – 5	–1,033	–1,043	–1,052	–1,496	–1,509	–1,523
WVDIFF – 4	–1,082	–1,059	–1,036	–1,567	–1,534	–1,500
WVDIFF – 3	–477	–58	360	–690	–84	522
WVDIFF – 2	–408	65	539	–591	94	780
WVDIFF – 1	–317	217	752	–459	314	1,088
NORMAL	4,560	6,840	9,120	6,600	9,900	13,200
N	1	1	1	1	1	1

The one obvious feature is again that the expected present value of pension benefits declines 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.

Final Salary $25,000			Final Salary $50,000		
20-Year Tenure	30-Year Tenure	40-Year Tenure	20-Year Tenure	30-Year Tenure	40-Year Tenure
79,855	92,130	104,405	110,490	130,873	151,256
74,546	87,680	103,924	104,846	127,313	150,007
70,081	84,009	112,287	100,447	124,857	156,816
66,364	83,964	120,471	97,148	123,350	170,478
63,310	90,640	128,407	94,808	129,091	183,789
60,836	97,162	136,028	93,295	139,642	196,637
62,885	102,189	141,492	91,610	148,476	206,947
67,321	106,923	146,524	98,781	156,887	216,587
70,731	110,026	149,322	105,018	163,361	223,525
73,865	112,742	151,618	110,929	169,314	229,722
76,686	115,029	153,372	116,434	174,652	235,071
0.916	0.754	0.673	0.760	0.654	0.597
0.876	0.738	0.685	0.747	0.661	0.614
0.846	0.727	0.742	0.744	0.673	0.655
0.825	0.742	0.798	0.748	0.689	0.717
0.810	0.803	0.853	0.759	0.734	0.777
0.802	0.862	0.905	0.775	0.798	0.835
0.835	0.905	0.940	0.786	0.850	0.880
0.892	0.945	0.971	0.849	0.899	0.923
0.932	0.966	0.984	0.902	0.936	0.952
0.968	0.985	0.993	0.953	0.969	0.977
1.000	1.000	1.000	1.000	1.000	1.000
2,046	1,715	185	2,175	1,372	481
1,893	1,557	−3,546	1,865	1,041	−2,887
1,733	20	−3,817	1,539	702	−6,373
1,567	−3,425	−4,072	1,200	−2,945	−6,830
1,396	−3,681	−4,301	853	−5,956	−7,252
−1,272	−3,121	−3,393	1,046	−5,484	−6,401
−3,030	−3,233	−3,436	−4,897	−5,745	−6,583
−2,561	−2,331	−2,101	−4,686	−4,864	−5,213
−2,590	−2,244	−1,898	−4,885	−4,919	−5,121
−2,564	−2,079	−1,594	−5,004	−4,852	−4,863
11,916	17,875	23,833	18,777	28,166	37,555
2	2	2	3	3	3

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

Table 3.6 1980 Expected Present Value of Pension Benefits: Defined-Benefit Conventional Plans (Sample: Valid EPV − 10 through EPV + 10)
Salary = $25,000, Tenure = 30 Years

Variable	Value	Variable	Value
EPV − 10	172,152	ERAT − 10	1.837
EPV − 9	164,207	ERAT − 9	1.755
EPV − 8	155,953	ERAT − 8	1.670
EPV − 7	147,497	ERAT − 7	1.583
EPV − 6	139,459	ERAT − 6	1.499
EPV − 5	131,337	ERAT − 5	1.415
EPV − 4	123,435	ERAT − 4	1.335
EPV − 3	115,517	ERAT − 3	1.253
EPV − 2	107,090	ERAT − 2	1.167
EPV − 1	98,892	ERAT − 1	1.083
EPV − 0	90,864	ERAT − 0	1.000
EPV + 1	81,761	ERAT + 1	0.899
EPV + 2	73,155	ERAT + 2	0.805
EPV + 3	65,256	ERAT + 3	0.719
EPV + 4	57,955	ERAT + 4	0.639
EPV + 5	51,232	ERAT + 5	0.565
EPV + 6	45,070	ERAT + 6	0.497
EPV + 7	39,446	ERAT + 7	0.435
EPV + 8	34,337	ERAT + 8	0.379
EPV + 9	29,718	ERAT + 9	0.328
EPV + 10	25,562	ERAT + 10	0.282
N = 13			

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 3.8 (col. 2) presents the results for the representative group (salary = 25,000, 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 0.1. It is less than one 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 has major impacts on pensions and therefore on retirement and tax revenues. We do not explore those implications here.

Table 3.7 **1975 Expected Present Value of Pension Benefits (Sample: Valid EPV−10 . . . EPV−0)**

	Group		
	Defined Benefits		
Variable	Conventional	Pattern	Defined Contribution
EPV−10	125,113	33,779	62,454
EPV−9	120,062	32,585	62,016
EPV−8	114,846	31,215	62,273
EPV−7	109,373	29,698	64,556
EPV−6	103,770	28,059	67,358
EPV−5	98,161	26,831	70,045
EPV−4	92,247	25,215	72,904
EPV−3	86,338	23,692	75,589
EPV−2	80,283	22,017	77,623
EPV−1	74,422	20,478	79,395
EPV−0	65,962	19,007	80,441
ERAT−10	2.052	1.764	0.782
ERAT−9	1.990	1.703	0.779
ERAT−8	1.922	1.633	0.785
ERAT−7	1.848	1.555	0.812
ERAT−6	1.768	1.471	0.846
ERAT−5	1.686	1.407	0.878
ERAT−4	1.596	1.323	0.913
ERAT−3	1.505	1.244	0.945
ERAT−2	1.409	1.157	0.969
ERAT−1	1.314	1.077	0.989
$N =$	127	42	11

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 3.8 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 10 years early has a salary of $15,348 rather than $25,000. Since conventional plans are contingent on 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

Table 3.8 1980 Expected Present Value of Pensions: Comparative Analysis (Sample: Valid EPV−10 . . . EPV−0)

Salary = $25,000, Tenure = 30 Years

	Defined-Benefit Conventional Plan			
Variable	Wage Growth = 0 r = .1 Social Security = 1980 (1)	Wage Growth = 0 r = .1 Social Security = 1975 (2)	Wage Growth = 5% r = .15 Social Security = 1980 (3)	Wage Growth = 0 r = .05 Social Security = 1980 (4)
EPV−10	107,585	115,384	75,317	98,194
EPV−9	10,511	112,624	72,110	99,791
EPV−8	101,951	109,222	68,908	100,673
EPV−7	98,212	105,190	65,751	100,866
EPV−6	94,213	100,945	62,739	100,629
EPV−5	90,176	96,537	60,051	100,129
EPV−4	85,524	91,512	56,973	98,769
EPV−3	80,656	86,313	53,779	96,880
EPV−2	75,143	80,482	50,347	93,876
EPV−1	69,863	74,810	47,206	90,727
EPV−0	63,165	67,749	43,452	85,261
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 3.9 **1980 Expected Present Value of Pensions: Comparative Analysis (Sample: Valid EPV − 10 . . . EPV − 0)**

Salary = $25,000, Tenure = 30 Years

	Defined-Benefit Pattern Plan			
Variable	Wage Growth = 0 r = .1 Social Security = 1980 (1)	Wage Growth = 0 r = .1 Social Security = 1975 (2)	Wage Growth = 5% r = .15 Social Security = 1980 (3)	Wage Growth = 0 r = .05 Social Security = 1980 (4)
EPV − 10	40,651	40,651	48,189	37,328
EPV − 9	40,103	40,103	45,650	38,291
EPV − 8	39,296	39,296	42,961	39,011
EPV − 7	38,262	38,262	40,178	39,489
EPV − 6	37,031	37,031	37,353	39,728
EPV − 5	36,164	36,164	35,134	40,201
EPV − 4	34,485	34,485	32,180	39,859
EPV − 3	32,716	32,716	29,326	39,314
EPV − 2	30,752	30,752	26,481	38,447
EPV − 1	28,767	28,767	23,797	37,358
EPV − 0	26,876	26,876	21,379	36,247
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

$N = 38$

repeated under the assumption that the nominal interest rate was only 5%. Column 4 of table 3.8 contains those results.

With a nominal interest rate of 5%, the decline in pension value does not occur until about 6 years before normal retirement for the representative group. However, for groups with longer tenure (=40) the decline occurs throughout the period for conventional plans and during the last 9 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 rates were around 16%. It is difficult to believe that 5% was the anticipated discount rate.

3.2.3 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. This section reports findings based on that sample. The results are presented in table 3.10.

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 10 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 5-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 Employment 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 retirement 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 on final salary which increases over time with inflation. This table makes comparisons based on equality of salary in nominal terms. But using the

Table 3.10 Matched Data: Pension Values (Sample: Valid EPV − 10 . . . EPV − 0)
Salary = $25,000, Tenure = 30 Years

Years before Normal Retirement	EPV80	EPV75	EPV80 − EPV75
		Conventional plans	
EPV − 10	99,981	102,380	−2,399
EPV − 9	97,554	98,815	−1,261
EPV − 8	94,583	94,874	−290
EPV − 7	91,241	92,823	−1,581
EPV − 6	87,617	88,272	−654
EPV − 5	84,049	86,952	−2,902
EPV − 4	79,727	82,376	−2,649
EPV − 3	75,201	79,034	−3,832
EPV − 2	70,260	73,616	−3,355
EPV − 1	65,715	68,334	−2,618
EPV − 0	61,232	61,907	−675
$N = 19$			
		Pattern plans	
EPV − 10	43,097	20,199	22,898
EPV − 9	42,476	20,179	22,296
EPV − 8	41,583	23,283	18,300
EPV − 7	40,451	22,842	17,609
EPV − 6	39,112	22,261	16,851
EPV − 5	38,660	25,111	13,548
EPV − 4	36,737	23,818	12,918
EPV − 3	34,729	22,724	12,005
EPV − 2	32,505	21,272	11,233
EPV − 1	30,274	19,925	10,349
EPV − 0			

information in tables 3.3–3.5 we can adjust the pension benefits to take this into account.

At tenure = 30, an increase in salary from $25,000 to $50,000 increases normal retirement value by (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 5-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 10 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 retirement 10 years early than they did in 1975. In both years and under any reasonable assumptions, the expected present value of pensions tends to decline with increases in the age of retirement.

3.3 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. Because illness is a bad event, workers may wish to insure against that contingency by paying higher pensions to early retirees.

At some levels, this story is not inconsistent with the model. Equations (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 destroys 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 others 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 severely 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.

3.4 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 has 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.

Notes

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 (1982) 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 make some plans fall by less than others.
6. There was only one matched defined-contribution plan.
7. To name a few, see Azariadis (1980), Arnott and Stiglitz (1981), Green (1981), Green and Kahn (1981), Grossman and Hart (1981*a*, 1981*b*).

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Through a substantial coding effort, Lazear has computerized the stipulations of a number of pension plans. Having done this, he has been able to compare the provisions of the plans with the predictions suggested by his theory. Although the idea is straightforward, the implementation of it is not simple, and, indeed, the data set that Lazear has created is interesting in its own right. The data are consistent with the theory. The chapter gives us a major piece of information: once the age of early retirement is reached, annual "earnings" in the form of pension benefits decline with additional years of employment, according to the provisions of a large group of pension plans.

Without Lazear's theory, I believe a standard prediction would be that workers are paid more than their marginal products early in their working lives, then less than their marginal products, and finally more than their marginal products toward the end of their working careers. That they are paid more late in life creates an incentive for them to continue working. Mandatory retirement is one way of bringing overpayment to an end. In any case, firms under this scenario have an incentive to get older workers to retire before the mandatory retirement age. What Lazear has added to this story is that judicious selection of pension parameters could theoretically tend to produce more efficient quitting. This is done by reducing retirement benefits from one year to the next in such a way as to just offset the difference between the wage rate and the marginal product during that year. The net marginal wage faced by the worker is equal to his marginal product, and thus it leads to efficient quitting decisions. Guided by this interpretation, Lazear's data seem to indicate that the divergence between wage and marginal product in these late years increases with age. At least this seems to be true for persons on defined-benefit plans. However, it seems not generally to be the case with respect to defined-contribution plans.

Again, using Lazear's interpretation of the data, it also turns out that the difference between wage and marginal product is greater for workers with long tenure with the firm and also for those with higher salaries. The possibility that short tenured workers may be paid less than their marginal product seems plausible to me, but the reasoning for higher-salary workers is to me more questionable. Lazear has argued that relative to blue-collar workers it is more difficult to monitor the performance of higher-salary workers and therefore in part the higher salary is a necessary incentive. On the other hand, in my limited experience with a large

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corporation, it was made clear to me that the highest-paid workers were the easiest to monitor and indeed that the firm cared relatively little about managers below middle management and would not normally take steps to fire them even if they were performing poorly. On the other hand, the claim was that the performance of people at higher levels of management was obvious from the performance of their divisions and that these people were paid more in part because their marginal contributions to the firm were potentially high. Also, it was claimed that these people would be dismissed if their performance did not live up to expectations.

Now let me say a bit more about the possible interpretations of the data. I agree with Lazear that the data seem to be inconsistent with a savings motivation for pensions, at least in the main.

I am not so sure, however, that the data are inconsistent with an insurance motive for pensions. People who retire early often say that they do so because of health status. Presumably persons believe that should poor health necessitate early retirement they would need higher benefits than if this contingency were not to arise. There are, of course, other insurance schemes that are more directly related to health than general retirement plans are, but to get disability insurance one presumably has to demonstrate disability. Declining health status may mitigate against working, yet a person may not be disabled in a strict sense and thus may want the added insurance of a retirement plan. There is, of course, a moral hazard problem when retirement benefits are allowed to act as insurance, which is, of course, what disability verification tries to guard against.

This leads me to wonder how Lazear's theory relates to individual differences among workers. Is the same scheme to apply to all? It does not seem to me that existing pension plans can reduce benefits in accordance with individual differences in marginal product versus wage. I am reminded of this difference because of the experience of a large Boston corporation that recently wanted to reduce its work force. The firm presumably set out to do this by a judicious selection of severance pay determined worker by worker, or at least based on individual work histories. After the fact, the firm apparently found that their incentive scheme was not—at least to the extent that it wished—encouraging those that they wanted to retain to stay, and those that they did not want to retain to leave. I wonder how pension plans in the aggregate could be expected to perform in this respect.

It is also interesting that Lazear's data seem to be consistent with his theory with respect to defined-benefit plans but the data on defined-contribution plans apparently are not. Does this mean that firms with defined-contribution plans have different lifetime salary structures of different implicit contracts with workers or that they have different work settings such that appropriate incentive schemes are different from those that apply in firms with defined-benefit plans? For example, construction workers may typically have defined-contribution plans while auto firm employees may have defined-benefit plans. Since the normal job tenure of the two groups is typically very different, the incentives of their pension plans might also be expected to differ. Also, the plans selected by Lazear for analysis are those that allow early retirement. Could it be that firms that allow early retirement are those that would like to dismiss some older workers and thus have pension plans that are consistent with this goal?

Along these lines, I think it would be interesting to compare salary structures in the relatively recent past, when pensions were much less prevalent than they are today, with salary structures that exist today. In particular, could one demonstrate that the divergence between wage and marginal product of older workers is greater now than it used to be? Finally, it seems to me that Lazear's evidence suggests the advantages that could be gained from longitudinal microdata that match individual salary trajectories and turnover (quitting) with pension plan parameters.

In summary: Lazear's chapter has contributed a major piece of information to our knowledge about pension plans. Together with his theory, this information helps us to understand a possible role of pensions: to encourage efficient retirement. A major portion of the plans considered by Lazear do appear to be consistent with this role, although others apparently are not. Thus the chapter raises several interesting issues for future investigation.

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