SHORTER ARTICLES

Rational Decision Rules for Early Retirement Inducements Contained in Corporate Pension Plans

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ABSTRACT

This article presents a net present value (NPV) model of early pension subsidies. The model's theoretical basis is the compensating differentials–lifetime contracts framework of the labor market setting which gives rise to pension plans. The NPV model effectively integrates early pension subsidies into the shareholder wealth maximization framework of corporate finance. Within this framework, the article develops rational decision rules for early pension subsidies, and employs these rules to provide a corporate finance perspective on the pension-wage tradeoff of the firm's labor force.

Many researchers have noted the significant and steady increase, since the 1960s, in the number of private pension plans of the defined-benefit type, which have formally liberalized their provisions for early retirement benefits (see Conference Board, 1971; Lazear, 1979; Burkhauser, 1979; Clark and McDermed, 1982; Ippolito, 1986; Mitchell and Luzadis, 1988; Hogarth, 1988; and Pesando and Gunderson, 1988). Typically, firms grant this liberalization through the collective bargaining process in response to workers' demands (McGill, 1984, p. 120), and it is commonly effected by adopting less-than-full actuarial reduction factors for determining pension benefits payable upon early retirement. As a result, eligible (older, long-service) workers who choose early retirement receive a pension subsidy, in the form of benefits above and beyond their actuarially equivalent benefit credits accrued to the early retirement date. In this manner, the corporate pension plan serves in part as a mechanism for inducing specific age-and-service cohorts of workers to retire early. Ippolito (1986, p. 148) notes that such inducements for orderly and homogeneous retirement have become "major characteristics of the U.S. private pension system." Similarly, Pesando and Gunderson (1988, p. 260) report a significant expansion of such inducements in the Canadian pension system over time.

Economic research on this inducement function of pension plans has for the most part been focused on its public policy implications and on its role as a

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determinant of workers' acceptance of early retirement. Ippolito (1986, p. 120) notes, by contrast, that "much less work has been done to demonstrate why firms choose to use their pension plans in this way." This is a pointed observation, especially if one considers the fact that the pension cost to a firm which offers such early retirement inducements may well be several times the cost of providing actuarially equivalent early retirement pension benefits (Winklevoss, 1977, pp. 148–9).

This article presents a financial model which integrates early pension inducements into the framework of shareholder-wealth maximization, through the net present value (NPV) criterion. The model's primary contribution is its provision of a conceptually well-founded and useful framework for determining the conditions under which a shareholder wealth maximizing firm should build an early retirement inducement mechanism into its pension plan design. Two theoretical insights from labor economics, which are instrumental for developing the NPV model, are first presented. The model is then formulated, its economic implications for the firm and its labor force are discussed, and some of the model's implications for future research are presented.

Theoretical Insights from Labor Economics

The labor market literature provides numerous insights into the nature and role of occupational pension plans as appendages of the sponsoring firms. Two such insights are particularly relevant for the purposes of this article. The first insight is provided by the compensating differentials (CD) model (Smith, 1937; and Rosen, 1974), for which empirical support based on wage and pension data has been mounting in recent years (Ehrenberg, 1980; Schiller and Weiss, 1980; Smith, 1981; and Allen, Clark, and Sumner 1986). Under the CD model, a worker's current wage demand internalizes a downward offset (wage concession) for each favorable aspect of pension coverage, and an upward offset (wage demand increment) for each unfavorable aspect of this coverage. In particular, if the firm incorporates an early retirement inducement into its pension plan provisions, then the present value of the firm's incremental pension cost (PVC) from doing so should be netted out against the present value of the savings stream (PVS) which would result from the workers' acceptance of wage concessions in response to this inducement. Thus, offering the inducement will be economically worthwhile for the firm if $NPV = PVS - PVC > 0$.

The second insight is provided by the lifetime contract (LC) model (Bailey, 1974; Gordon, 1974; Azariadis, 1975; and Treynor, Regan, and Priest, 1976), for which direct empirical support from the labor market has also been growing (Brown, 1982; Wise and Kotlikoff, 1985; and Pesando, 1985 and 1987). Under the LC model, pension benefits are not to be viewed as discretionary promises, but as binding contractual obligations from firms to workers. Thus, firms' treatment of their pension obligations should reflect the "highest degree of certainty" (Treynor, Regan, and Priest, 1976, p. 45) that

these obligations will be fully discharged at maturity. In particular, the firm's pension funding policy under the LC model should be based on a valuation which uses a riskless discount rate for the pension obligations (Pesando and Clarke, 1982). Similarly, the firm's valuation of the compensating wage differentials (concessions) for pension benefits should also employ a riskless discount rate, since these concessions, like the pension promises which give rise to them, are an integral part of the lifetime contractual arrangement between the firm and its workers.

An NPV Model of Early Pension Inducements

The two preceding insights provide a theoretical basis for identifying (i) the incremental costs and savings associated with pension inducements for early retirement, and (ii) the appropriate discount rate (the riskless rate) for valuing these costs and savings. Formulation of an NPV model which uses these ingredients is now possible.

Notation

T = Years to normal retirement;

N = Years to the earliest date of eligibility for retirement;

A = Worker's attained age;

α_{N+i} = Actuarially-equivalent pension discount factor for each year by which retirement precedes the normal retirement date;

α^* = Liberalized, uniform pension discount factor;

$W_{A,0|\alpha}$, $W^*_{A,0|\alpha^*}$ = Current wage demand of a worker whose attained age is A, given pension discount factors α_{N+i} and α^* respectively;

g = Salary growth rate assumption;

b = Pension benefit rate as a percentage of some salary base;

r = Riskless discount rate;

$B_{A,N|\alpha}$, $B^*_{A,N|\alpha^*}$ = Expected value of pension benefits payable as of the earliest possible retirement date, given pension discount factors α_{N+i} and α^* respectively;

$\Pi_{A,i}$, $\Pi_{A,N+i}$ = Multiple-decrement probability of surviving in active service for the next i years ($i = 0, 1, \ldots, N-1$) and the next $N+i$ years ($i = 0, 1, \ldots, T-N$) respectively;

$P_{N+i|\alpha}$, $P^*_{N+i|\alpha^*}$ = Probability of being retired at the end of $N+i$ years ($i = 0, 1, \ldots, T-N$), given pension discount factors α_{N+i} and α^* respectively;

$\bar{P}_{N+i|\alpha}$, $\bar{P}^*_{N+i|\alpha^*}$ = Probability of retiring at the end of $N+i$ years ($i = 0, 1, \ldots, T-N$) and not earlier, given pension discount factors α_{N+i} and α^* respectively.

Formulation

The following NPV model is based on the assumption of a unit-benefit final-salary base, although the model could just as readily be developed for any other benefit formula. If the firm initially uses an actuarially-equivalent pension discount factor, α_{N+i}, then:

$$B_{A,N|\alpha} = b(W_{A,0|\alpha})\sum_{i=0}^{T-N}(1+g)^{N+i}(N+i)[1-(\alpha_{N+i})](\Pi_{A,N+i})(\bar{P}_{N+i|\alpha})/(1+r)^i \quad (1)$$

If the firm liberalizes its early retirement provisions by adopting a uniform, reduced pension discount factor, α^*, then:

$$B^*_{A,N|\alpha^*} = b(W^*_{A,0|\alpha^*})\sum_{i=0}^{T-N}(1+g)^{N+i}(N+i)[1-\alpha^*\{T-(N+i)\}](\Pi_{A,N+i})(\bar{P}^*_{N+i|\alpha^*})/(1+r)^i \quad (2)$$

The firm's expected incremental pension cost (IPC_N) from this liberalization, at the end of N years, has a present value:

$$PV_0\,(IPC_N) = [(B^*_{A,N|\alpha^*}) - (B_{A,N|\alpha})]/(1+r)^N \quad (3)$$

The firm's expected incremental savings consist of a stream of wage concessions (compensating wage differentials, CWD_i) over the employees' expected worklife, whose present value is:[1]

$$PV_0(CWD_i) = [(W_{A,0|\alpha}) - (W^*_{A,0|\alpha^*})]\sum_{i=0}^{N-1}\left(\frac{1+g}{1+r}\right)^i(\Pi_{A,i}) + \sum_{i=0}^{T-N}[(W^*_{A,0|\alpha^*})(\bar{P}^*_{n+i|\alpha^*}) - (W_{A,0|\alpha})(\bar{P}_{N+i|\alpha})]\left(\frac{1+g}{1+r}\right)^{N+i}(\Pi_{A,N+i}) \quad (4)$$

The NPV, to the firm, of adopting an early retirement inducement mechanism through α^*, is:

$$NPV_0\,(\alpha^*) = PV_0(CWD_i) - PV_0(IPC_N) \quad (5)$$

Thus:

$$NPV_0(\alpha^*) \gtreqless 0 \text{ as } PV_0(IPC_N) \gtreqless PV_0(CWD_i) \quad (6)$$

Gauging the Pension Inducement for Early Retirement: A Rational Benchmark

McGill (1984, p. 120) notes that more and more pension plans are using uniform, arbitrary reduction factors for early retirement benefits. For example, α^* may be set at 6 percent for each year by which early retirement precedes normal retirement. Relation (6) readily provides a rational

[1] Note that early retirement inducements may increase the firm's labor productivity by removing less productive workers from the workforce. Thus, there may be other, non-wage savings to the firm which may consist of various cost reductions associated with this increased productivity. For many, if not most firms, the present value of these cost reductions may be non-negligible, and it should be added to $PV_0(CWD_i)$ in equation (4). However, the estimation of these cost reductions requires information about the production process, age structure of the workforce, productivity by age cohort, and other firm-specific details. Thus, for simplicity, these cost reductions are not included in equation (4), although they could readily be incorporated into the NPV model if the required firm-specific information were available.

(shareholder wealth maximizing) benchmark against which α^* can be compared. Thus, if α^*_c denotes the critical value (i.e., $NPV_0(\alpha^*_c) = 0$) of the liberalized pension discount factor, then:

$$NPV_0(\alpha^*) \gtreqless 0 \text{ as } \alpha^* \gtreqless \alpha^*_c \tag{7}$$

where:[2]

$$\alpha^*_c = \frac{(W_{A,0|\alpha})}{(W^*_{A,0|\alpha^*})}\left(\frac{U-X}{Q}\right)+\frac{V}{Q}-\frac{1}{bQ(W^*_{A,0|\alpha^*})}[Y+\{(W_{A,0|\alpha})-(W^*_{A,0|\alpha^*})\}Z\left(\frac{1+r}{1+g}\right)^N] \tag{8}$$

and the values of Q, U, V, X, Y and Z are as defined in the Appendix. Furthermore, the $NPV_0(\alpha^*)$ from this liberalization, as determined from relation (6), is:

$$NPV_0(\alpha^*) = [(W_{A,0|\alpha})-(W^*_{A,0|\alpha^*})]Z + \left(\frac{1+g}{1+r}\right)^N [Y+b\{(W^*_{A,0|\alpha^*})(\alpha^*Q-V)+(W_{A,0|\alpha})(X-U)\}] \tag{9}$$

In summary, for any contemplated α^*, the acceptance/rejection decision rule expressed in relation (7) can be stated either in terms of the benchmark α^*_c determined through equation (8) or (in the more conventional capital budgeting framework) in terms of the incremental $NPV_0(\alpha^*)$ to the firm, as expressed in equation (9).

The Pension-Wage Tradeoff

Introducing a pension inducement for early retirement involves a tradeoff of liberalized pension benefits for wages. From the firm's perspective, it is important to determine the smallest wage concession for which it would be worthwhile to offer the inducement. This critical wage concession would set $NPV_0(\alpha^*) = 0$ in equation (9), and is given by:

$$W_{A,0|\alpha} - W^*_{A,0|\alpha^*} = W_{A,0|\alpha}\left[1-\frac{\{Z-\sum_{i=0}^{T-N}\left(\frac{1+g}{1+r}\right)^i(\bar{P}_{N+i|\alpha})(\Pi_{A,N+i})+b(X-U)\}}{\{Z-\sum_{i=0}^{T-N}\left(\frac{1+g}{1+r}\right)^i(\bar{P}^*_{N+i|\alpha^*})(\Pi_{A,N+i})+b(V-\alpha^*Q)\}}\right] \tag{10}$$

[2] The full derivation of equations (8), (9) and (10) is omitted for space constraints, and will be provided by the author to interested readers upon request.

Note that equation (10) holds for the case where $PV_0(CWD_i) = PV_0(IPC_N)$. This implies that at a minimum, the employees should accept a dollar-for-dollar concession in their present-value lifetime wages (since $PV_0(CWD_i)/PV_0(IPC_N) = 1.00$)[3], in order for the pension inducement (α^*) to be consistent with shareholder-wealth maximization. In other words, the employees' marginal rate of wage-pension equalization (MRWPE) should at the most equal -1.00.

Previous empirical research sheds some light on the magnitude of the MRWPE. In particular, Smith (1981, p. 467) provides regression results which appear to lend much greater support to the notion that workers accept less than dollar-for-dollar wage concessions, than to the notion that they accept dollar-for-dollar or larger wage concessions in return for pension benefit liberalizations. Consequently, these empirical findings may leave the impression that, by and large, firms which offer pension inducements for early retirement may be deviating from shareholder-wealth maximization. However, the fact that such inducements have grown into a major characteristic of the private pension system makes the preceding suggestion look highly implausible. Thus, further consideration of the empirical evidence is called for, especially with regard to the role of the age structure of the workforce as a determinant of the pension-wage tradeoff.

Schiller and Weiss (1980) present evidence which indicates that the MRWPE is lower for younger employees than for older ones. In light of equation (10), this evidence suggests that a positive $NPV_0(\alpha^*)$ may only be attainable with older employee cohorts, whereas $NPV_0(\alpha^*)$ may be predominantly negative for younger cohorts and, in any event, will be much smaller than for older ones. Thus, the economic worthwhileness to the firm, of granting pension inducements for early retirement, may largely depend on whether the $NPV_0(\alpha^*)$ for older cohorts is not only positive but also large enough to overwhelm the potentially negative $NPV_0(\alpha^*)$ for younger cohorts. This would probably be the case in a plan with an over-mature active population (see McGill, 1984, p. 240).

The preceding analysis gives a new, corporate finance perspective on the pension-wage tradeoff of workers. Furthermore, it brings to light the fact that existing and future research on this tradeoff may have important implications for rational decision-making by firms in the pension and retirement area.

Conclusion

This article has demonstrated that the inducement aspect of corporate pension policy can be integrated into the shareholder-wealth maximization framework through the NPV criterion, which has been widely used in modelling various policy problems faced by the firm. The model presented above is theoretically well founded, and thus it may serve as a groundwork for

[3] Note that in capital budgeting terms, $PV_0(CWD_i)/PV_0(IPC_N)$ is the benefit/cost ratio for the pension inducement "project."

further extensions of the corporate finance framework into the area of pension benefit and retirement policy. In order to provide a fuller understanding of the pension contract including the early retirement option, such extensions should be carried out in the context of the firm's overall personnel policies, which are concerned with total (wage, pension, fringe benefit, and other) compensation, with other labor costs, and with the age structure of the firm's labor force.

At the empirical level, an important question which arises from the above model is whether and to what extent the introduction of early retirement inducements in real-life corporate pension plans is consistent with shareholder-wealth maximization. That is, is $NPV_0(\alpha^*) \gtrless 0$ in these plans? Questions of this nature should be investigated in future empirical research aimed at assessing the sign, magnitude and statistical significance of the effects of such inducements on the market value of the firm's equity.

Appendix

$$Q = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i (N+i)[T-(N+i)](\Pi_{A,N+i})(\bar{P}^*_{N+i|\alpha^*}) \tag{A-1}$$

$$U = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i (N+i)(\alpha_{N+i})(\Pi_{A,N+i})(\bar{P}_{N+i|\alpha}) \tag{A-2}$$

$$V = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i (N+i)(\Pi_{A,N+i})(\bar{P}^*_{N+i|\alpha^*}) \tag{A-3}$$

$$X = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i (N+i)(\Pi_{A,N+i})(\bar{P}_{N+i|\alpha}) \tag{A-4}$$

$$Y = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i [(W^*_{A,0|\alpha^*})(\bar{P}^*_{N+i|\alpha^*}) - (W_{A,0|\alpha})(\bar{P}_{N+i|\alpha})](\Pi_{A,N+i}) \tag{A-5}$$

$$Z = \sum_{i=0}^{T-N} \left(\frac{1+g}{1+r}\right)^i (\Pi_{A,i}) \tag{A-6}$$

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