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SOCIAL SECURITY AND PENSIONS

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ABSTRACT

Recent and proposed changes in the social security statutes can have profound effects on worker behavior and on pensions themselves. In the context of an optimal lifetime compensation plan, pensions depend on efficient dates of retirement. To the extent that changes in social security affect the efficient date of retirement, both the pension and the wage profile itself will react. Four proposed changes in the social security system are analyzed. The cost savings associated with the change, as well as the effect on pensions and worker compensation in general are discussed.

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This essay is an attempt to understand the effects of proposed changes in the rules governing the receipt of social security on private pension formulas. Four policy proposals are considered. Both short-run and long-run implications are analyzed. An empirical strategy, which allows the estimation of the magnitudes of the effects, is described. In addition to examining the effects on pension formulas, an intermediate step is the determination of changes in retirement behavior. A by-product is a discussion of the effects of the proposed changes on costs to the social security system.

I. Social Security and Optimum Retirement

The basic assumption to be employed throughout this analysis is that firms and workers agree to engage in arrangements that are privately efficient. This implies that they maximize the joint value of output and leisure. More specifically, it implies that work occurs when and only when the private value of work exceeds the value of the worker's leisure. There is a large literature that employs this notion. Becker, Landes, and Michael (1977), Lazear (1979), Hashimoto and Yu (1980), and Hall and Lazear (1984) are a few examples of a principle that is by now reasonably well understood among practitioners.

The reason that the "privately efficient" is distinguished from efficient is that social security creates distortions which enable firms and workers to act opportunistically against the system.[1] By selecting one date of retirement over another, it is possible to make both firms and workers better off. This

[1] A related idea was exposited by Feldstein (1976) and pursued by others including Topel (1983).

is because there is no monotonic link between the amount received in social security payments by the worker and the length of the work life so the relation of contributions to benefits received is not appropriate for efficiency.[2] The implication is that changes in social security are likely to affect the private optimum date of retirement. In order to understand the effects of social security on private pensions, it is first necessary to understand the way that the social security system alters the retirement decision.

There are five primary ways that the social security system distorts the relationship between workers' worth to the firm and the value of leisure. The first is the vesting provision. Social security requires that (under most circumstances) a worker have 40 contributing quarters in order to be fully insured. This means that the value of working the 40th quarter far exceeds the value of output produced by the worker at the firm.

Second, social security benefits levels are a function of the average wage that the worker receives over his entire lifetime (adjusted for wage inflation). If the worker's productivity is not constant over the lifetime, his average wage is affected by when he chooses to retire. This is derived more formally below, but it implies that a worker can affect the size of his benefits by altering his retirement date.

Third, it has been argued convincingly (see, for example, Gordon and Blinder (1980), Mitchell and Fields (1984), Burkhauser (1976)), that social security is not actuarially neutral of the date of retirement, independent of the wage effect already mentioned. The current consensus is that workers who retire before 65 do not have benefits with expected present values as high as

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[2]The relationship sometimes goes the wrong way since workers who remain with the firm for a longer time pay a larger amount in, but may actually receive less in benefits from the system if they continue to work beyond 65.

otherwise identical workers who retire at 65. The direction of the bias is not essential. What is important is that the value of benefits is not independent of the age of retirement.

Fourth, the earnings test implies that workers who continue to work beyond age 65 lose benefits permanently that are not made up in higher payments later on. This implies that even if the present value of benefits rises with work to age 65 (or more exactly, with the election to defer receipt of payments until 65), the reverse is true for work beyond that date. More will be said about this issue below.

Finally, since the system is financed by the current working generation (and its employers), continuing to work increases the contributions to the system without necessarily changing the amount of benefits. This link is the least well defined, however, because of the pay-as-you-go nature of the system. Not only is any one worker's benefits in large part independent of his contributions to the system, but an entire generation's benefits may be independent of its contributions.

With these points in mind, let us derive the worker's true wage at each point in his life cycle as a function of age of retirement.

The worker's problem is to maximize lifetime utility. In this simplest of problems there are two components: leisure and pecuniary wealth, which are assumed separable in the utility function. The worker can select the number of years of work after which to retire. If $Y(t)$ is the worker's pecuniary wealth if he works t years including social security, $L(T' - t)$ is the total value of leisure when he works t years, where T' is the year of death, then the worker's maximization problem is

$$\max_{t} \; Y(t) + L(T' - t) \tag{1}$$

with first-order condition

$$Y'(t) = L'(T - t) \ . \tag{1a}$$

Equation (1a) says that the worker should equate the value of incremental leisure with his income per period since $Y'(t)$ is income.

For the purposes of this study, $Y(t)$ consists of three components: direct earnings from work (net of taxes including FICA), social security wealth, which the worker creates by participating in the covered sector of the labor market, and pension wealth. In a competitive labor market, it must be the case that the worker's total income through T equals his total lifetime product through T, where T is selected time of retirement. Let $V(t)$ be the present value of lifetime product through year t and $v(t)$ be the incremental product associated with the t^{th} year of work. Define $W(T)$ as lifetime wage income. If pension wealth were zero, then

$$V(T) = W(T) \tag{2}$$

However, it need not be true that

$$V'(t) \equiv v(t) = w(t) \equiv W'(t)$$

for any t. It is not necessary that the wage at any point in time equal that year's marginal product.

Now, social security wealth, S, depends not only upon years worked, but also upon the average salary, adjusted for inflation. So

$$S = S(T, \bar{w}(T)) \tag{3}$$

where $\bar{w}(T)$ is the average salary earned through T, conditional upon retirement at T (adjusted for inflation). The properties of $S(\cdot)$ have already been mentioned. First,

(4) (a) $S_1 = 0$ for $T < T^*$ where T^* is the normal date of retirement (currently 65)

(b) $S_1 < 0$ for $T > T^*$

(c) S is discontinuous at 10

(d) $S_2 \geq 0$.

Statement (4c) is the vesting rule. Statement (4d) says that up to a point, the higher are average earnings, the higher are social security benefits. Statement (4b) is the earnings test: Work beyond the normal date results in the withdrawal of benefits, which are never made up. Statement (4a) says that years of service (other than 10) do not affect benefits. This may seem confusing, given the earlier statement that early retirement benefits are lower than normal retirement benefits. But retiring at, say, $T^* - 3$, does not require that the worker receive benefits at that point. In fact, if workers could borrow against social security wealth, no one would ever elect to start benefits before T^*, irrespective of the date of retirement. Below the assumption of perfect capital markets is relaxed.[3]

Equation (2) implies that

(5) $$\int_0^T v(t)e^{-rt}dt = \int_0^T w(t)e^{-rt}dt \ .$$

Also,

(6) $$\bar{w}(T) \equiv \frac{1}{T}\int_0^T w(t)dt \ .$$

If $r = 0$, then from (5) and (6),

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[3]This also implies that the earnings test between years $T^* - 3$ and T^* is irrelevant since workers always would opt for zero benefits between $T^* - 3$ and T^*.

$$\bar{v}(T) \equiv \frac{1}{T}\int_0^T v(t)dt = \bar{w}(T)$$

so that

(7) $$\frac{d\bar{w}}{dT} = \frac{d\bar{v}}{dT} = \frac{1}{T}\,(v(T) - \bar{v}(T)) \ .$$

Equation (7) says that the change in the average wage from one additional year of work must be the same as the effect of the marginal product of that year on the average, independent of the shape of the age-earnings profile. Since totals must add up, averages must be the same. This means that for these purposes, the wage profile is irrelevant. Only the $V(t)$ profile must be analyzed.

Somewhat aside, if $r > 0$, then there is an incentive to steepen the profile relative to the true productivity profile. By "lending" to the firm, the worker gets to count the firm's interest repayment as part of the average wage upon which social security payments are based.

For simplicity, assume that $r = 0$ so that (3) becomes

(8) $$S = S(T, \bar{v}(T)) \ .$$

Now, the private return to work T is

$$\begin{aligned} Y(T) &= W(T) + S(T, \bar{w}(T) \\ &= V(T) + S(T, \bar{w}(T)) \end{aligned}$$

so from (5), (7), and (8), $y(T)$, defined as the change in private wealth associated with retiring one year later, is

(9) $$\begin{aligned} y(T) &= v(T) + S_1 + S_2\,\frac{d\bar{v}(T)}{dT} \\ &= v(T) + S_1 + \frac{S_2}{T}\,(v(T) - \bar{v}(T)) \ . \end{aligned}$$

Then (1a) can be written as

$$L'(T' - T) = v(T) + S_1 + \frac{S_2}{T}(v(T) - \bar{v}(T)) \; . \tag{1a'}$$

A typical pattern is illustrated in Figure 1.

The $y(T)$ path shown is the value of working the T^{th} year on the assumption that year T is the final year. For $T < 10$, there is no social security effect. At $T = 10$ there is a spike in the $y(T)$ function because the worker becomes fully insured at $\bar{v}(10)$ earnings. For $10 < T \leq T^*$, $S_1 = 0$, but $\frac{d\bar{v}(T)}{dT} \neq 0$. At T_0, $v(T_0) = \bar{v}(T_0)$, but for $T > T_0$, the marginal is below the average, pulling it down. At $T > T^*$, the earnings test takes hold so that each additional year's earnings are offset by a corresponding decrease in social security wealth. This causes a kink in the y function since S_1 is no longer zero and its effect must be added to that of $S_2 \frac{d\bar{v}}{dT}$.

Note that in Figure 1, social security induces earlier retirement than would otherwise occur. The earnings test pushes in this direction, but so does gearing benefits to average wage when the final years are associated with declining productivity.[4] Additionally, zero interest tends to artificially depress the slope of y relative to that of v. Figure 2 illustrates another possibility where social security may or may not result in earlier retirement depending upon the value of leisure. If leisure value is L' rather than $\tilde{L}'$, then the social security system induces later retirement.

The point is that it is privately optimal (for the firm and worker jointly) to declare that retirement occurs at the time when the worker's value, including increases or decreases in social security, equals the value

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[4]This result is similar to that of Carliner and MacDonald (1980).

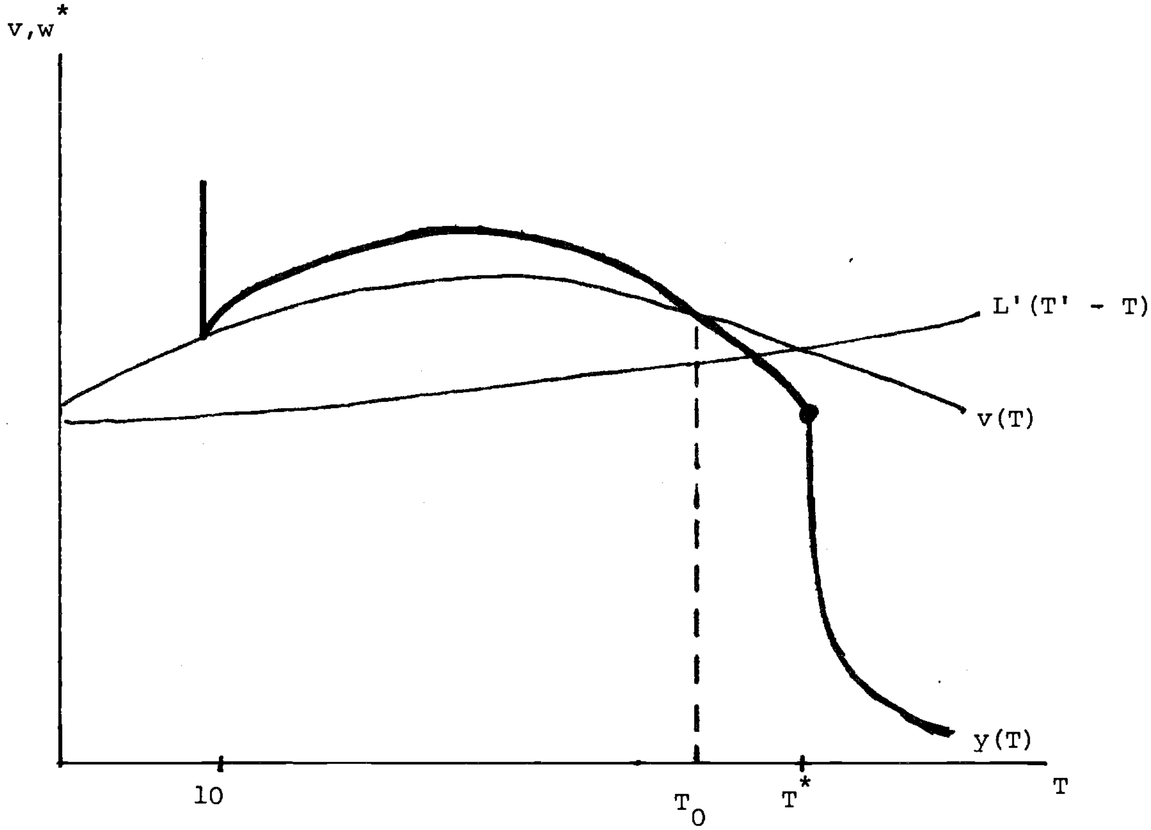

Figure 1

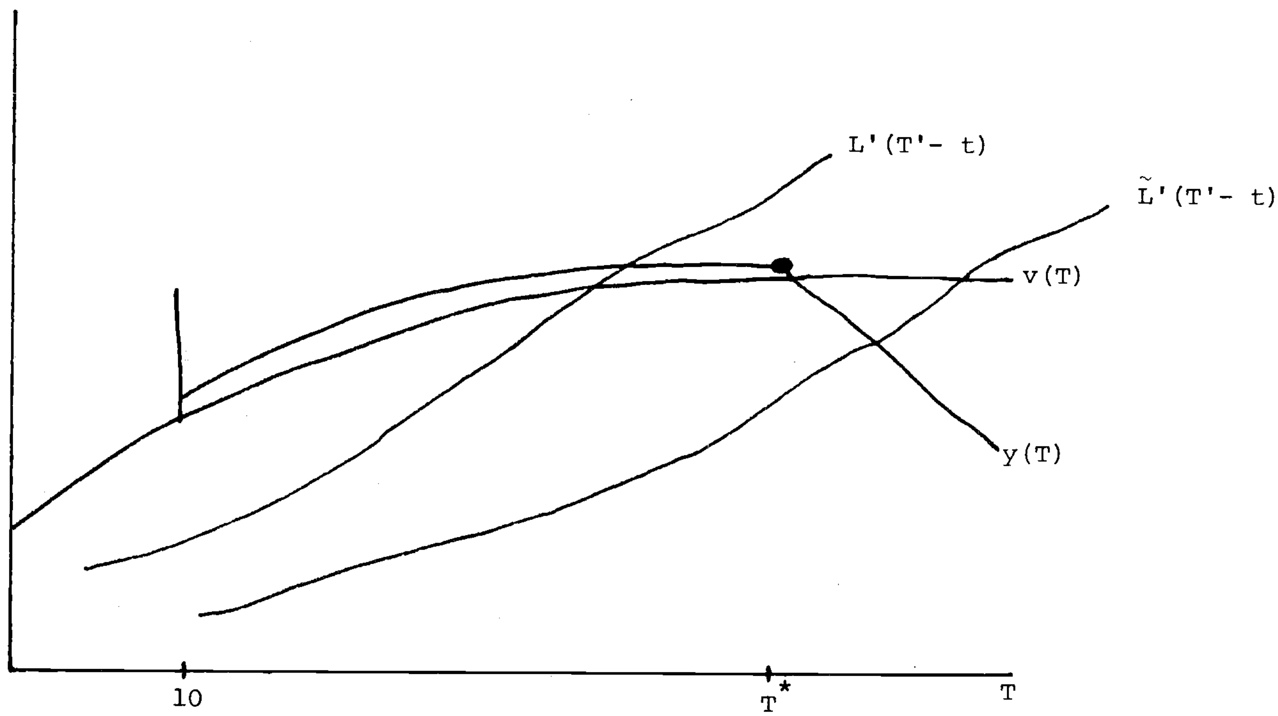

Figure 2

of his leisure. Changes in social security payments are likely to change that date.

II. Total Worth, Wages and Pensions

The $y(T)$ path that was derived in the last section can be thought of as the total private worth of the worker. It is linked to pensions and wages because the worker's pension and wage path affects the date at which the worker chooses to retire. It is privately efficient to have the worker retire at the intersection of $y(T)$ and $L'(T' - T)$, but the worker only chooses that date if it is forced upon him (via mandatory retirement) or if his total compensation is set up in a way that induces him to choose the efficient date as his optimum.

The theory that links pensions and wages to retirement is exposited in four papers (Lazear 1979, 1981, 1983, 1984). It would require too much space to fully exposit those ideas here, so only a sketch of the methodology with more explicit derivations of the essential relationships is provided.

In Lazear (1979), I argued that an age-earnings profile that was steeper than the age-productivity effects would produce incentives for the worker to perform more efficiently on the job. By paying workers less than they are worth when young and more than they are worth when old, the young and old alike are induced to work harder than they otherwise would. Steepening the profile raises the cost of losing the job for poor performance.

There are two direct consequences of this approach for motivating workers: First, a pension or some lump sum after retirement is a necessary part of the optimal profile. This ensures that the effort level during the final years is the efficient one (derived explicitly in Lazear (1981)).

Second, the profile distorts the labor supply decision. Workers, left to their own devices, choose to quit work when the value of leisure exceeds the wage, not the true value of work. If the worker could be forced to work only when it was efficient to do so, then all, including the worker, could be made better off. Herein lies the explanation for mandatory retirement. Mandatory retirement, by forcing the worker to retire at the efficient age, permits the firm to pay the worker the appropriate amount over his lifetime. If the worker were permitted to work beyond that date, the distortion in labor supply induced by tilting the age-earnings profile would cause him to work longer. But the value of these additional years to the firm falls short of the value of forgone leisure. Thus, over the worker's entire lifetime (although not during the final years) the increment in payment does not cover the cost of leisure. The firm that uses mandatory retirement at the appropriate date is able to attract all workers.

Figure 3 illustrates this. The worker is worth y in the final year T. Paying the worker $w(T)$ rather than $y(T)$ provides the appropriate incentives for effort. The problem is that the worker prefers to retire at T_1 rather than T^*. If the worker were permitted to work until T_1, then in competition the firm would pay the worker the present value of OABC over his lifetime. With mandatory retirement at T^*, the firm pays OADE, but the worker has additional leisure from T^* to T_1. The mandatory retirement scheme is better iff the value of the additional leisure exceeds the incremental payment to the worker. This amounts to asking whether EDFC is larger than EDBC. It is under all circumstances.

This distortion is not confined to retirement at T. Tilting the age-earnings profile causes workers to be too reluctant to leave, even when departure would be worthwhile. It turns out that a cleverly chosen pension

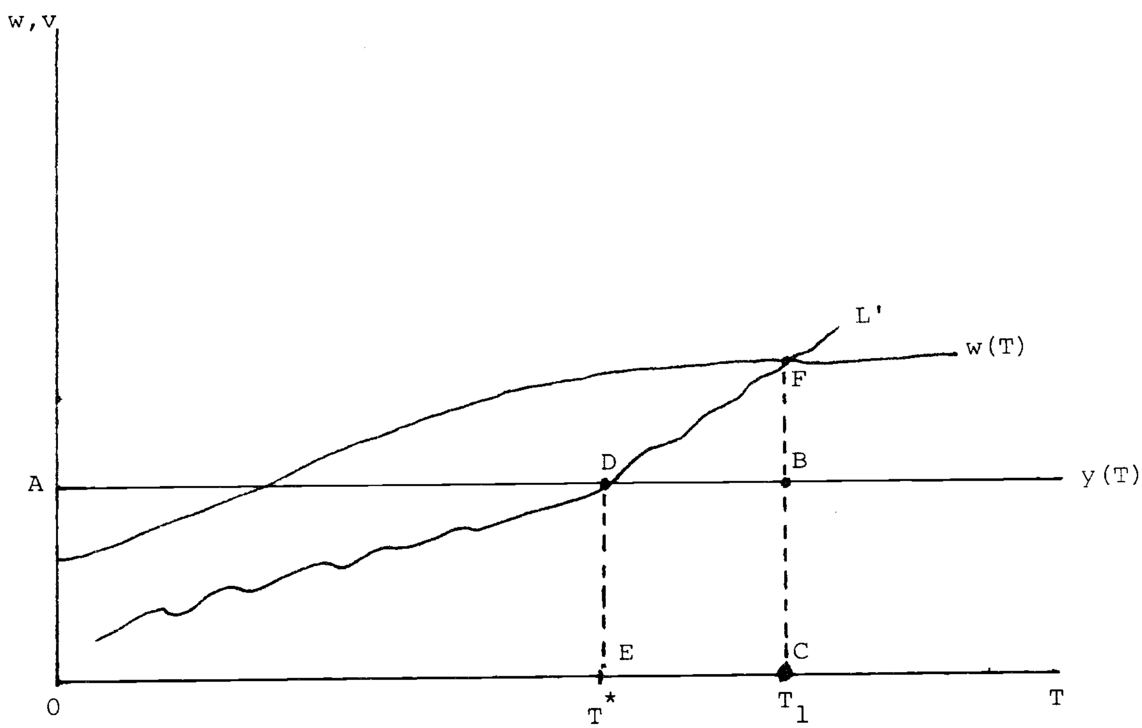

Figure 3

plan can rectify the situation. Figure 4 illustrates the problem and the solution.

Suppose that a worker receives wage $w(T)$ for each year through T^* and a pension, the value of which is EFGH, upon retirement at T^*. The size of EFGH is chosen to solve the end-period effort problem, taking into account the worker's access to capital markets, his desired savings, progressive income taxes, and his confidence that the firm will not default on its pension promise. (All are discussed in detail in Lazear (1981).)

The problem is that at t_0, the worker may find that his alternative use of time is unexpectedly high, say w_0. This might result because he receives an unexpected outside offer, or because the value of his leisure rises, say, due to illness. The worker chooses to remain because $w(t) > \tilde{w}_0$. Yet all could be made better off if the worker were to leave. In fact, the appropriate amount of severance pay could make all better off.

In Lazear (1983, 1984), I show that the efficient severance pay is ABCD + EFGH. Under these circumstances, the firm is indifferent between retaining or losing the worker. If he stays, the firm pays t_0BCT^* + EFGH and gets value of t_0ADT^*, yielding a quasi-loss of ABCD + EFGH. If he leaves, the firm simply makes a direct payment of ABCD + EFGH. Both policies yield the same profit to the firm. But the worker benefits by leaving only when it is efficient. If $\tilde{w}_0 > v^*(t)$, then the worker receives ABCD + t_0JKT^* + EFGH, which exceeds t_0BCT^* + EFGH.

This implies that the optimal severance pay is ABCD + EFGH. A pension, the expected present value of which declines with age of retirement beyond t^*, can act as exactly this kind of severance pay. Indeed, in Lazear (1983, 1984) I find strong evidence to suggest that the decline in present value of pension benefits (stock--not flow) with age of retirement is widespread.

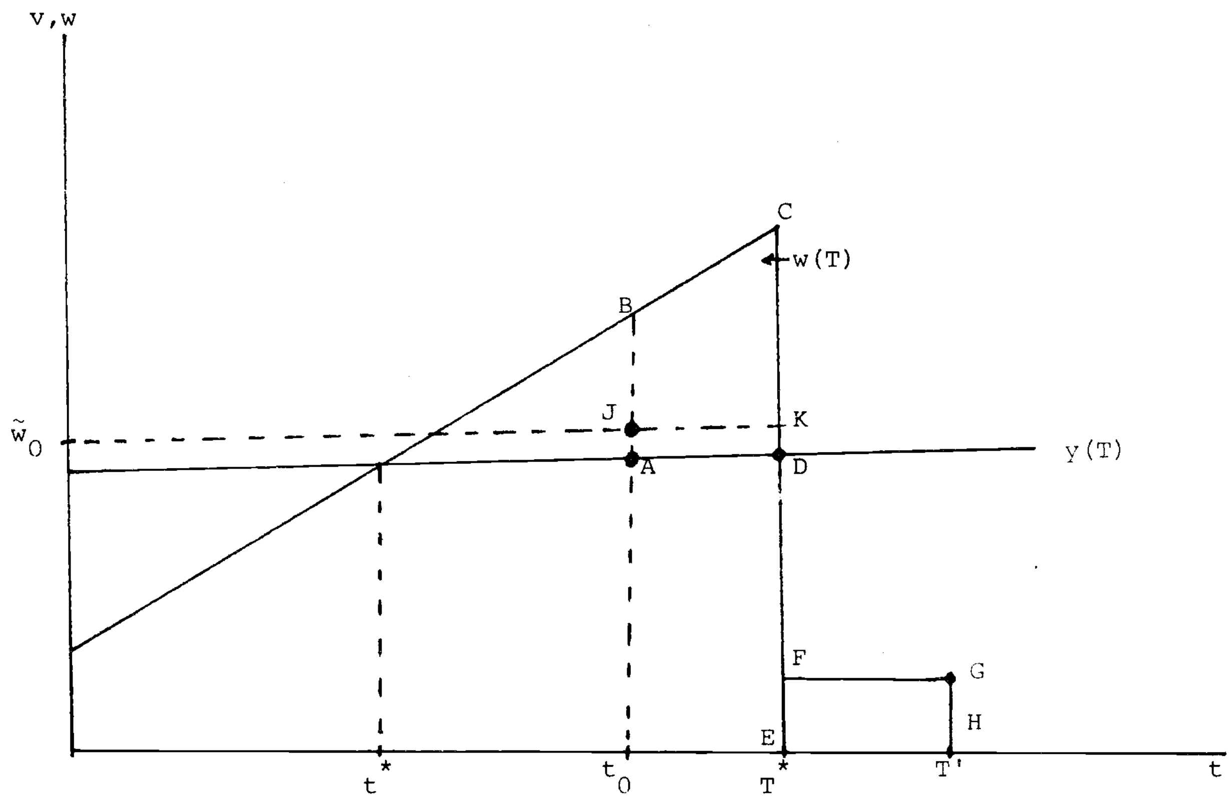

Figure 4

The link between pensions, $y(t)$, and $w(t)$ is established: Let $P(T)$ be the expected present value of the pension if retirement occurs at time T. Assume that $\tilde{w}(T) > y(T)$ implies that $\tilde{w}(t) > y(t)$ for $t > T$. For simplicity, continue to assume that interest is zero. Then the worker retires at time $T^* - 1$ iff

(10) $$\tilde{w}(T) + P(T-1) > w(T) + P(T) .$$

Select the pension optimally so that

(11) $$P_{T-1} - P_T = w(T) - y(T) .$$

Substitute (11) into (10) to obtain the result that the worker retires early when and only when

$$\tilde{w}(T) + P_{T-1} + w(T) - y(T) > w(T) + P(T)$$

or when

(12) $$\tilde{w}(T) > y(T) ,$$

which is the criterion for private efficiency.

III. Social Security and Pensions

All the necessary tools are now available to analyze the impact of changes in social security on pensions. Since equation (11) gives the relationship between pensions, wages and y, we need only determine the effects of social security on $y(T)$, and to a lesser extent on $w(T)$ and $P(T^*)$. Neither $w(T)$ nor $P(T^*)$ are likely to be affected much by changes in social security relative to $y(T)$. The determinants of $w(T)$ and $P(T^*)$ have to do with life cycle savings, capital markets, and firm default. Of these, life cycle savings is the determinant most likely to be affected, but even its role is limited. Each is considered along with the various policy changes.

A. Delay Without Reduction in Social Security

(1) The Basic Analysis

The first policy to be considered does not imply any direct cost savings for the social security system, but indirect savings are present. Consider shifting the entire actuarial relationship that currently exists for retirement between 62 and 65 to ages 65 to 68. The expected present value of pension benefits, given retirement at 65 would be equal to the current expected present value for retirement at age 62. Similarly, 66 corresponds to 63, and so forth.

The key to understanding the effect on pensions is to understand how this alters the basic shape of $y(T)$ as shown in Figure 1. Equation (9) is the determining factor.

Define T^* as the number of years of work that corresponds to retirement at age 65. Then for $T < T^* - 3$, the policy has no effect on $y(T)$ since, from equation (9), neither $v(T)$, S_1 or S_2 is altered. Whether or not there is a change between age 62 and age 65 depends upon the assumption about capital markets. For this policy change and the next, continue to assume that capital markets are perfect. For the last two changes, that assumption is relaxed to illustrate the differences that are introduced by this assumption.

If capital markets are perfect, and workers can borrow against their social security wealth, then S_1 is zero between 62 and 65 because workers need not take the benefits early, even if they retire early. But under the current regime, it always pays to begin the benefits at age 65 and then the earnings test starts to bite. Reductions in social security payments via the earnings test are not made up so the $y(T)$ declines more steeply after 65.

Under the proposed scenario, workers would not elect to receive social security until age 68 because to do so would reduce the present value of benefits. But after age 68, the earnings test would take hold. Figure 5 shows the change.

Under the new policy, the earnings test does not become binding until age 68, or at $T^* + 3$. The kink that exists at T^* under the current system shifts to $T^* + 3$. Further, the decline is more rapid on the $y_1(T)$ function than on the $y_0(T)$ function. The reason is that the payment per year is larger on y_1 than on y_0 in order to keep actuarial values the same while making benefit payments over a smaller number of years.

The effects on retirement age depend upon the value of the alternative use of time. Individuals who would have retired under the old regime between T^* and T_0 will delay retirement somewhat. The switch to the new system makes work between T^* and T_0 more rewarding so some individuals are induced to remain in the labor force longer. However, there are those with values of leisure between L_0 and L_1 who would have retired at T^* under the old system, but at T such that $T^* < T < T^* + 3$ under the new system. Those workers receive benefits that are less than the full value because of the non-neutral relationship of early retirement social security to normal retirement social security. But they would have received the full amount under the old system because they retire after T^* under the old system. This implies that social security costs are reduced on these individuals.

Individuals whose value of leisure lies between L_1 and L_2 also retire later under the new regime. But the effects on the cost to the system are ambiguous here. Under the old regime, those workers would have worked beyond T^*, forgoing some benefits as a result. The same is true in the new regime. The difference is that under the old system, the worker receives benefits for

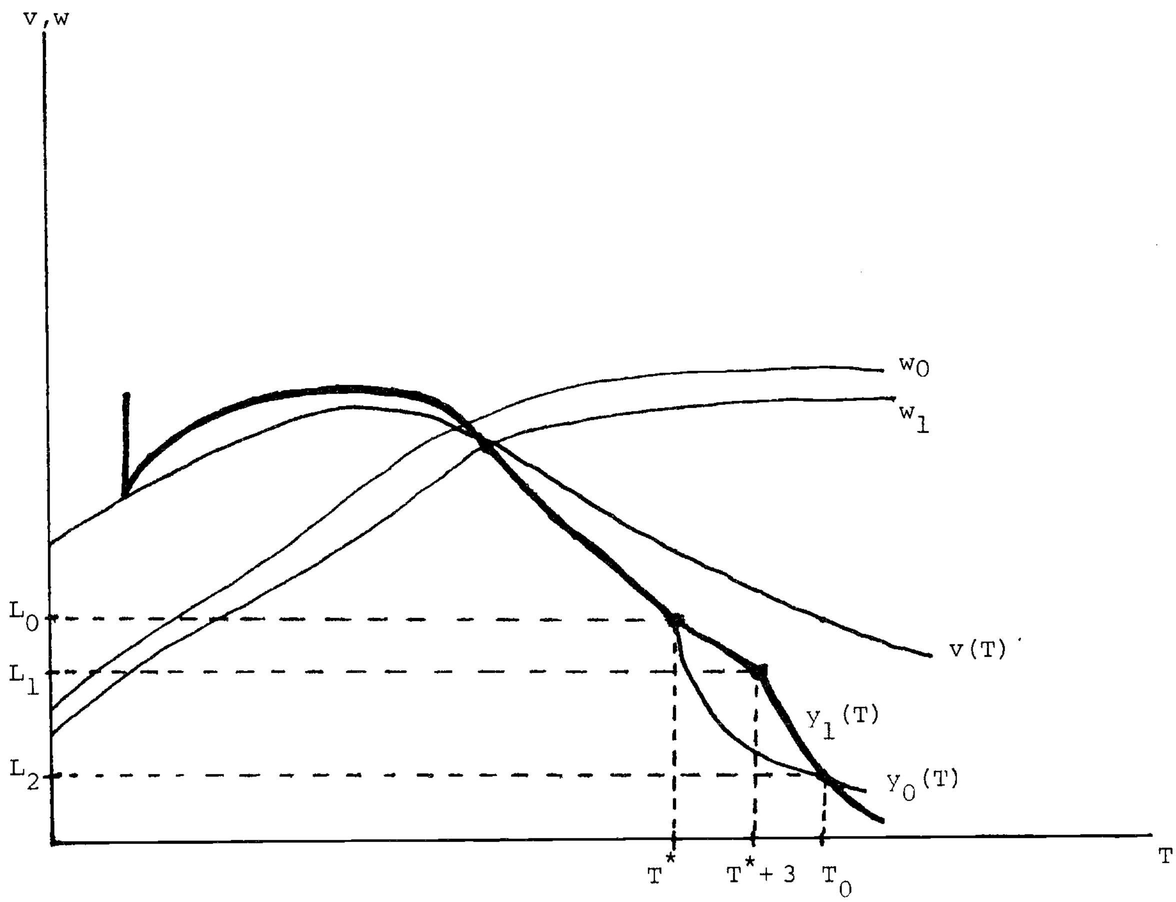

Figure 5

a greater number of years than in the new system. But because actuarial values are the same across systems at normal retirement age, the benefits per year are smaller under the old system. The net effect is ambiguous.

Workers who have a value of time that is lower than L_2 retire at an earlier age under the new regime than under the old. Here the effect is to increase costs to the social security system. Under the old system these workers received benefits for fewer years and the benefits per year were smaller.

In order to derive the effect of the policy change on pensions, it is necessary to examine what happens to the wage path and to the pension at the normal date of retirement. Since the kink in the v function has moved from T^* to $T^* + 3$, it is now likely that the modal age of optimal retirement will move from age 65 to age 68. This means that pensions are likely to follow suit, declaring that as the normal age of retirement. But what is "normal age" is in large part semantics. What is important is the relation of value of pensions taken before that date to pensions taken at that date. Equation (11) allows us to examine what happens.

If it were privately optimal for workers to work longer under the new regime, then either the wage profile or pensions at normal retirement age must be adjusted downward. The reason is that during the final years, workers are overpaid relative to their worth to the firm. The longer they remain with the firm, the greater is the quasi-loss, which must be made up by an adjustment in the profile or the pension. One would expect that the adjustment would work partly through the pension and partly through the wage. Fewer years of retirement imply that in a life-cycle savings context, workers prefer to take relatively less of their income after retirement.

This logic, along with equation (11), yields specific implications for the way that pensions change with the change in social security policy. First, the normal age of retirement goes up. Second, the pension received upon reaching normal age is smaller. (This implies a smaller accrual rate for each year of work.) Third, since $w_1(t)$ lies below $w_0(t)$ and since y_1 lies above y_0 between T^* and $T^* + 3$, the rate of decline in pension benefits with additional years of work after age 65 is smaller in the new regime than in the old. The intuition is that since it is privately optimal to work for more years, the pension is set up in a way that is less likely to discourage delayed retirement beyond age 65. Fourth, using the same logic, before age 65, the decline in pension value with delayed retirement is less pronounced under the new structure than under the old. But the differences will not be great. Until age 65, the only differences that result come from the change in the age-earnings profile, not in the y function. Those changes are not likely to be large. Finally, changes in the decline in pension value with additional years worked after T_0 are ambiguous. The shift in the y function is in the same direction as the shift in the w function so the net effect on $W - V$ is ambiguous.

In addition to these direct effects, there may be indirect effects as well. Since the present value of the pension upon attainment of normal age is smaller and since the rate of decline in pension benefits for delayed retirement before normal age is smaller (dP_T/dT is closer to zero), this implies that total pension payments are likely to be smaller as well. But in competition workers must be paid their lifetime marginal products. Only if the additional overpayment in wages that occurs between the old T^* and the new normal age, $T^* + 3$, (since $w(T) > v(T)$ for $T > T^*$) exactly offsets the reduced pension costs, are there no indirect effects. Otherwise, the pension and/or wage profile must be readjusted to ensure that

$$(13) \qquad \int_0^{T^*+3} w(t)e^{-rt}dt + P(T^* + 3) = \int_0^{T^*+3} v(t)e^{-rt}dt$$

holds, where $T^* + 3$ is the normal date of retirement. This is the lifetime constraint that workers be paid their marginal products. Since this net effect is necessarily ambiguous, a priori, and it may not be unreasonable to assume that the effects cancel each other out.

In a nutshell, a change in social security that moves the entire actuarial relationship back three years tends to reduce the average pension level, but more importantly, to reduce the penalty associated with delayed retirement.

2. An Empirical Strategy

It is possible to be more specific for empirical implementation. What is required is information on y_0, y_1, w_0, w_1, P_{T^*} under the old system and P_{T^*+3} under the new system. What is currently observable is w_0, P_{T^*}, the current and proposed social security payments and how they vary with age of retirement. The rest of the variables are not directly observable. However, knowing the structure of the social security system allows us to obtain the y functions once v is known. Equation (9) permits that inference.

The first trick is to infer v_0 from existing data. As I have shown in Lazear (1983, 1984), this can be done under the assumption that the pension system is set up efficiently. In fact, equation (11) is all that is needed. The only thing that is not observed in equation (11) is y. It can be inferred by using this difference equation and information on the current pension plan, and the current wage profile. This, along with equation (9), allows estimation of the v_0 profile. Once the v_0 profile has been identified using the present data, it is a simple matter to couple it with the proposed social security system to obtain y_1, again using equation (9).

All that is missing now is information on w_1 and on P_{T^*+3} under the new system. As already mentioned there is some ambiguity here. However, we are not without some guidance. First, there are constraints placed on the relationship between P, w and v. In particular, zero profits implies that equation (13) must hold if all individuals retired at the normal age. One assumption that is not unreasonable is that the pension value at $T^* + 3$ is reduced relative to that under the old system at T^* to reflect shorter retirement life. For example, if individuals previously retired at 65, lived to 80 and received a pension the expected present value of which was $200,000, then under the new system, they would get 12/15 of $200,000, or $160,000 as pension. This number, along with the v(t) profile already estimated, can be substituted into equation (13) to determine the change in the present value of the w(t) path. Although there is no way to say specifically how that path would change, again some sort of proportional reduction would not be unreasonable as a first approximation. An alternative is to assume that the annual pension flow would be kept constant.

This technique identifies all the relevant variables. The information generated along with equation (11) allows the analyst to estimate the exact shape of the private pension path that will correspond to the new social security structure.

3. Short Run vs. Long Run

This discussion has focused on the long run, ignoring any effects that might occur during some interim stage. There is the short run to consider, however, for workers who are currently with the firm, have a wage path already established, and already have pension rights. What is likely to happen to their pensions?

For the most part, this is not an important issue. It is unlikely that a change in the social security system of the kind being considered will not have enough lead time built into it so that the long run analysis is appropriate for almost all workers. Even if the change is to occur within five to ten years, there are sufficient degrees of freedom in the wage and pension accrual paths to allow the arrangement to quickly approach that of the long-run equilibrium.

Still, it is interesting to examine what might happen in the short run if the change in the structure of social security were to occur immediately and were completely unanticipated. The issue is best addressed by asking whether there exists a mid-career Pareto move that can be made, given the history of wages and pension accrual.

Consider a worker who has not yet reached T^*, the old regime's date of normal retirement. If there were to be no change in the wage profile, then it would be optimal to flatten the rate of decline in pension value for retirement delayed to some time between T^* and T_0 in Figure 5. By the logic of equations (10)-(12), such a change induces the worker to leave only when privately optimal and this necessarily can make the worker better off without making the firm worse off. However, given the current pension already accrued, flattening the pension decline in a way that was not anticipated when the wage and pension accrual paths were set up serves to increase the cost of the worker to the firm. To the extent that this increased cost is not offset by increased output (and in these final years of work, that is likely to be the case), the worker's compensation must be reduced somehow.

There are two obvious candidates. The first is the level of pension benefits to which the worker would be entitled at T^*. If this can be reduced, then the rate at which pension declines with age of retirement can also be reduced without a corresponding increase in expected pension costs. There are some legal restrictions on what employers can do to reduce pension values. What would be necessary here is a slowdown in the rate of pension accrual before T^* and a speedup in accrual rates from T^* to T_0. Whether or not this can be accomplished in the current legal and union environment is questionable.

The second candidate is the wage profile itself. The appropriate trade-off is to flatten the wage profile at the same time that the pension decline is lessened. In order to do this while creating the correct incentives, the reduction in wages relative to the current structure must occur for workers with less than T^* of seniority. Otherwise, all that is accomplished by flattening the pension decline is undone by the reduction in wages. What would be most preferred, although hardly feasible, is to levy a once-and-for-all lump sum tax on the current work force, to be given back in higher pension benefits later on.

Unfortunately, it turns out that even with lump sum taxes, there is no way to alter the shape of the age-compensation profile mid-stream without raising distributional issues.[5] The way to see this is to show that there is no wage-pension path that brings about efficiency and also leaves the firm no worse off across all workers. It can be accomplished for any one group, but not for all, even if a lump sum fee is charged.

Letting 0 denote the existing and 1 denote the proposed, consider a worker who, under the old regime, would have retired at T^*, but under the new regime should retire at $T^* + 1$ for private optimality. If C is the lump sum, then it must be true that, at one year before retirement,

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[5]This is not a problem when workers first join the firm because sorting occurs so that no worker is at a disadvantage by joining that particular firm.

$$(14)\quad w_0(T^*) + P_0(T^*) - v(T^*) = w_1(T^*) + w_1(T^*+1) + P_1(T^*+1) - v(T^*) - v(T^*+1) - C.$$

Equation (14) ensures that profits do not change as a result of the scheme (since profits were zero under the old scheme).

Although $v(T)$ is exogenous and w_0, P_0 are predetermined, it is still possible to set P_1 and w_1 in a way that guarantees efficiency via equation (11). Because of the free parameter, C, no change in profit is necessary.

This is no longer true once we recognize that there are other individuals with different retirement behavior at the firm. For example, consider an individual who would have retired at $T^* + 1$ under the old scheme, but at $T^* + 2$ under the new. In order to leave the firm indifferent, equation (15) must hold:

$$(15)\quad \begin{aligned} & w_0(T^*) + w_0(T^* + 1) + P_0(T^* + 1) - v(T^*) - v(T^* + 1) \\ & = w_1(T^*) + w_1(T^* + 1) + w_1(T^* + 2) + P_1(T^* + 2) \\ & \quad - v(T^*) - v(T^* + 1) - v(T^* + 2) - C . \end{aligned}$$

Subtracting (15) from (14) yields

$$(16)\quad \begin{aligned} 0 = & \; w_0(T^* + 1) + P_1(T^* + 1) - P_0(T^*) - v(T^* + 1) \\ & - w_1(T^* + 2) + v(T^* + 2) - P_1(T^* + 2) + P_0(T^* + 1) . \end{aligned}$$

To guarantee private optimality, (11) must hold so that

$$(17)\quad \begin{aligned} \text{a.}\quad & P_0(T^* + 1) - P_0(T^*) = y_0(T^* + 1) - w_0(T + 1) \\ \text{b.}\quad & P_1(T^* + 2) - P_1(T^* + 1) = y_1(T^* + 2) - w_1(T^* + 2) . \end{aligned}$$

Substitution of (17a, b) into (16) yields

$$(18)\quad v(T^* + 2) - y_1(T^* + 2) = v(T^* + 1) - y_0(T^* + 1) .$$

But the relationship between y and v is exogenous to the firm, determined solely by the social security system as in (9). Thus, it is impossible to guarantee that (18) will hold. Redistributive effects are a necessary consequence. The way that firms and workers iron out these differences cannot be resolved here. This requires a theory of bargaining. As such, short-run changes cannot be specified unambiguously.

B. Equal Flows Deferred to Later Ages

The next policy change that is considered is a shift in the flow of benefits to older ages. Specifically, consider making age 68 the date of normal entitlement, at which point entitlees would receive the same annual benefit flow as they currently do at age 65. Similarly, 65 would become the age of early retirement and they would be entitled to the same annual benefits then as they currently are now at age 62. Such a change results in an apparent cost savings because the actuarial value of the pension is reduced (same payment for fewer years).

In many ways this is similar to the previous analysis, but there are some differences. Some of the ambiguities about the dates of retirement and the cost of the system are removed. Again, with the help of equation (9), Figure 6 can be constructed to illustrate the differences between the before and after y profiles.

There are two notable shifts. First, it remains the case that the perfect capital market assumption guarantees that receipt of social security payment begins at the peak of actuarial value, but not before. This implies that the kink point moves from T^* to $T^* + 3$. Second, since the actuarial value of social security benefits is smaller at normal age under the new regime than under the old, the deviation of y from v tends to be smaller.

It is clear that such a scheme induces an increase in the age of retirement for most individuals. Anyone whose alternative value of time lies above

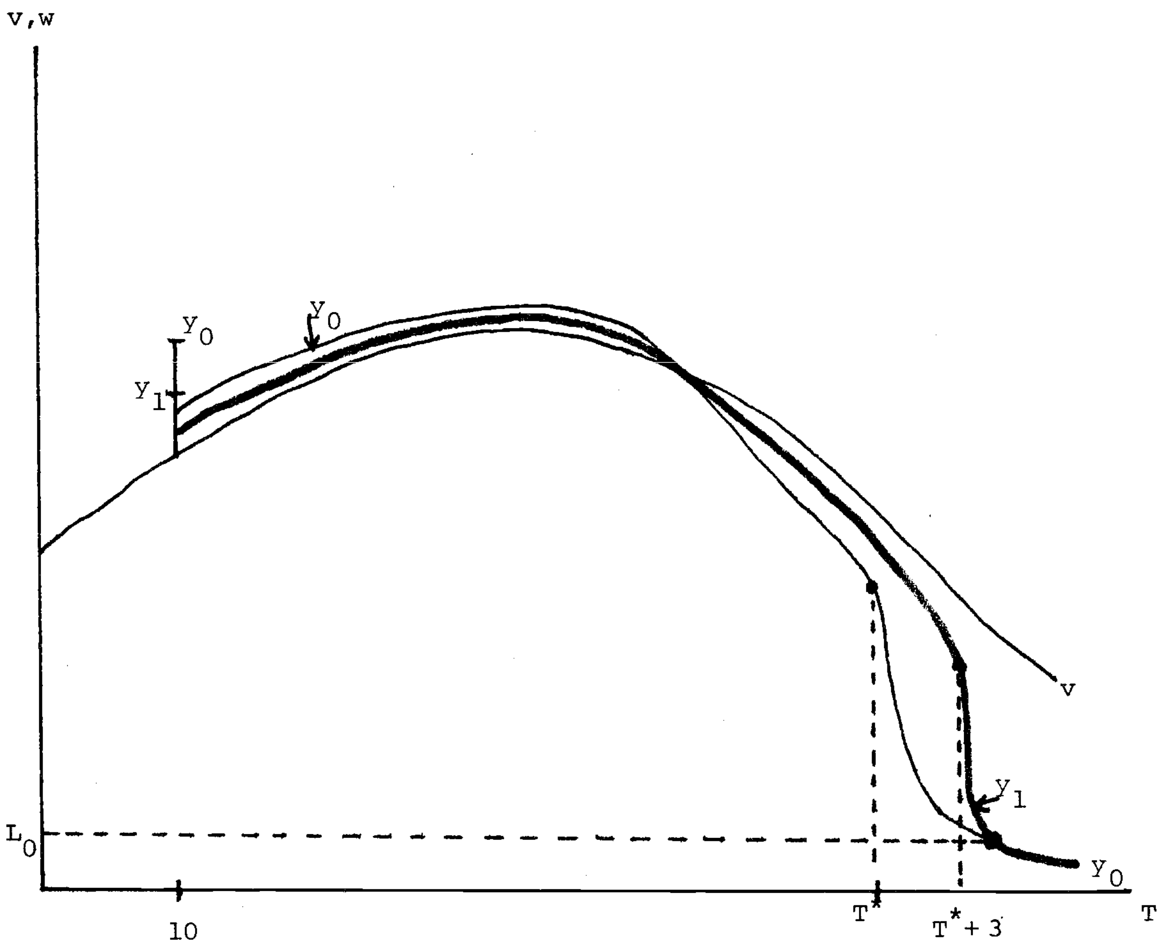

Figure 6

L_0 retires earlier under the new scheme than under the old. All of those for whom the alternative value of time lies below L_0 have unchanged retirement behavior. This implies an unambiguous reduction in the cost of the social security system. No workers receive benefits for a larger number of years under the new system than under the old and each year pays the same benefits as it would have before. Additionally, if $\frac{d\bar{v}}{dT} < 0$, then the benefits per year are reduced as well from continued work (from (18)).

Since the average age of retirement rises, it is likely that the firm will change the normal age of retirement to reflect this. In fact, it is likely to change to $T^* + 3$. What is the effect of the change on normal age pension benefits? Again, since there are fewer years of retirement, life cycle savings models imply that the pension value received upon normal age falls as the normal age is increased. So the expected present value of pension benefits received upon normal retirement falls. This does not imply that the annual flow of pension benefits will fall. A working hypothesis is that the flow of benefits per year might be left approximately unchanged as a function of age of retirement. I.e., current pension formulas which define benefits as a function of years of service, salary, and other factors will be set so as to make the pension flow associated with retirement at age 68 similar to what it would have been before if work had continued to age 68.

Even if annual pension benefits conditional upon retirement at age 68 remain unchanged, it is clear that the rest of the pension formula does change. As before, if the wage profile adjusts at all, its direction of change seems reasonably clear. The new $w(T)$ path is likely to lie somewhat below the old one, in order to retain the relationship given by (13), that expected present value of payment and output must be equalized. Maintaining the $w(t)$ path at its old level or dropping it in this fashion has an unambiguous effect on pension formulas. It implies that the expected present value of pension benefits should decline more slowly as a function of age of retirement. Since $w(T) - y(T)$ is smaller under the new scheme than the old up to and perhaps beyond $T^* + 3$ (if $w(T)$ falls), it is clear, using equaton (11), that pension present value must decline more slowly. Intuitively, this says that since there is now more private gain to postponement of the retirement date, the pension should be set up in a way that encourages later retirement. So as before, this change in social security includes smaller private pensions that decline more slowly with postponed retirement. Indirect effects are the same as in the first case considered in (A) and are not repeated here. Similarly, the empirical strategy to be used to estimate the new pension path is identical to that described above.

1. Short Run vs. Long Run

The same kind of analysis as performed above can be done here to distinguish the short run from the long run. As already mentioned, short-run impacts are not likely to be important because of lead times built into most contemplated changes in social security policy. Still, the effects are briefly considered.

The short-run changes are virtually identical to those of the previously considered policy change. Again, the goal is to find a Pareto move that takes as history the path of wages and pension accruals to that point and restructures the remaining profile from there.

Since later retirement is the objective, and specifically, since a less rapid decline in pension value is now desired, accrual rates should be adjusted upward, especially in the years following T^*. The difficulty, as before, is that this imposes larger costs of labor services on the firm without offsetting increases in output. Also as before, it is impossible to alter wages and pensions in a way that is both privately optimal and distributionally neutral. Even the imposition of a lump sum tax, with higher pension flows later, cannot make all workers better off while leaving the firm indifferent in every situation. If workers choose different dates of retirement, the lump sum that is appropriate for some is not appropriate for others.

C. Increase the Actuarial Reduction Associated with Early Retirement

Another policy that seems to reduce the cost to the social security system is a decrease in early retirement benefits, which leave benefits unchanged for retirement at age 65 (T^*). The reason that this does not obviously reduce the cost to the social security system is that it changes the average age of retirement and this may offset any cost savings that accrue from reduced benefit payments.

The effects of this policy on y illustrate the importance of the assumption of perfect capital markets. If workers can borrow and lend at the market rate of interest, then there are no effects of this policy at all. Since the present value of social security benefits taken at age 65 are higher than benefits that begin in any other year, any change to the system that leaves untouched benefits in year of normal entitlement has no effect on y. The y function is affected by maximum attainable benefits, as a function of age of retirement; all other values are irrelevant. Under these circumstances, there is no effect on retirement or pensions of the policy change.

This is no longer true if capital markets are imperfect. At the extreme, suppose that workers can neither borrow nor lend and must consume only what they receive as wages, pensions, or social security during that particular year. With a concave utility function, workers would elect to begin receipt of benefits as soon as they retired. The fact that there are a significant number of individuals who do opt to start benefits before 65 implies that the perfect capital market assumption is untenable. Under the assumption that the worker consumes only what he earns in that particular period, the y function shifts as shown in Figure 7.

Beginning at $T = 10$ years, the spike is smaller for y_1 because an individual who retires with only 10 years of experience is likely to elect to receive benefits starting at 62. This also implies that S_2 is likely to be smaller, so y_1 deviates from v by less than does y_0. At age 62, $(T^* - 3)$, both y_0 and y_1 kink upward because S_1 becomes positive at that point due to the non-neutrality of the actuarial relationship. The kink is sharper on y_1 than on y_0 because the actuarial value of early retirement is lower under the new policy so delaying retirement to age 65 is worth more. After age 65, the paths converge since the new policy changes nothing for retirement after that age.

It should be noted that it is not necessarily the case that y_1 deviates from v by a smaller amount than y_0. This depends upon the cross partial, S_{12}. It is possible, for example, the cross partial to be zero even though any given $\bar{V}$ results in a smaller present value of social security benefits.

Also recall that what has been assumed implies that workers take their social security benefits at the earliest possible entitlement date. This is quite different from what was assumed in the first two cases. In those two examples, the analysis does not change drastically. Here, it makes all the difference because there are no effects unless workers do not take social security in a way that maximizes the present value of their benefits.

First, consider the effects of this policy on retirement. There is no effect on those who would have retired after T^* since the policy does not alter y after that point. For those individuals for whom it was previously

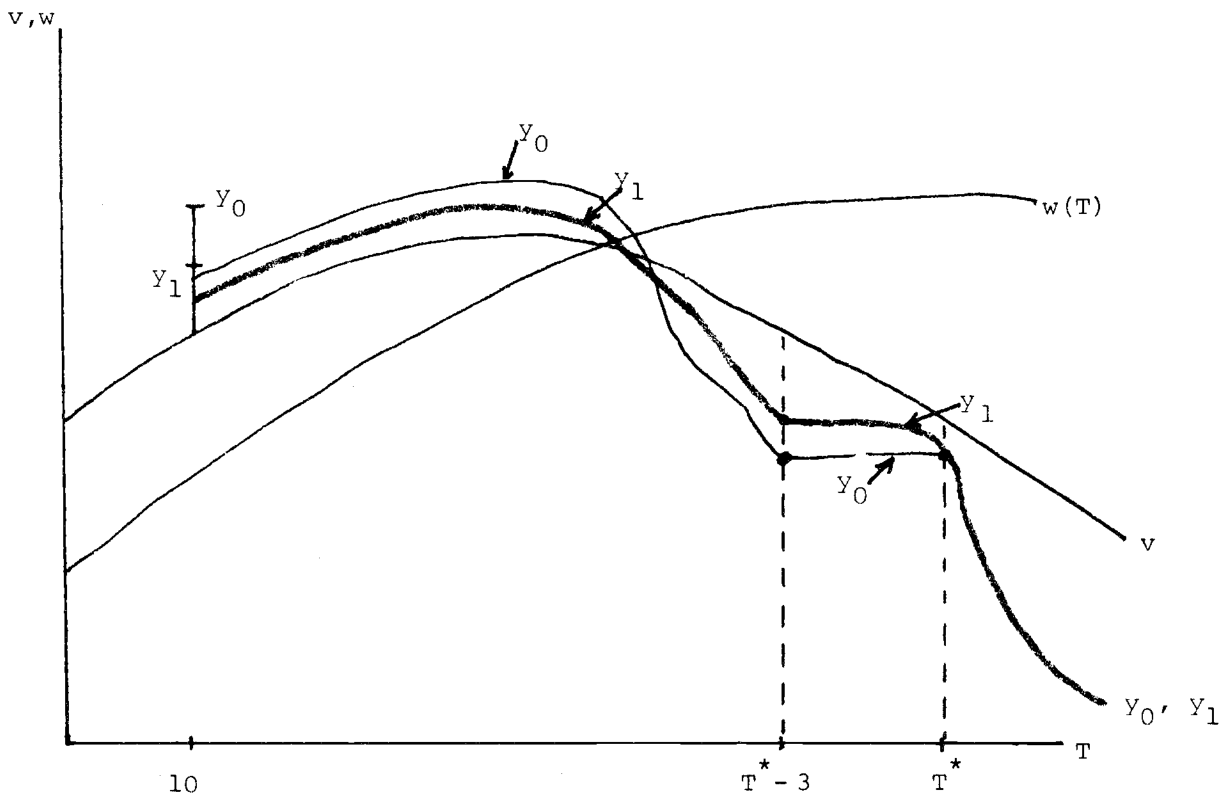

Figure 7

optimal to retire between $T^* - 3$ and T^*, retirement will be delayed somewhat under the new system. Under no circumstances is it delayed beyond age 65, but some delay is a necessary consequence of this policy change. The reason that it cannot be delayed beyond age 65 is that each member of this group retired at or before 65 (T^*) under the current system. This implies that the value of leisure intersected y_0 before T^*. Since y_0 and y_1 converge at 65, there is no possibility of privately optimal retirement beyond this point.

The postponement of retirement, which comes about because the private value of working an additional year is higher between T^* and $T^* - 3$ under the new system, introduces an ambiguity into the effects of the policy change on the costs of the social security system. Although each year of early retirement benefits cost less under the new system and there are fewer years during which benefits are received, that age at which the worker retires differs under the two policies. Since age of retirement is later, and since benefits are higher for individuals who begin benefits later, the per year benefit could actually be greater on average under the new system. The sign of the net effect depends upon the shapes of the two functions as well as the value of leisure curves.

Let us turn to the effects on pensions. Again, it is first necessary to determine the effects on P_{T^*}. Since T^* does not change, and since workers are more rather than less likely to retire at or near T^*, there is no obvious reason to expect any change in P_{T^*}. The same is true of the wage path. Since that path is efficiently conditional upon retirement at normal age, and since that age does not change, there is no reason to expect $w(T)$ to change.

This implies that $w(T) - y(T)$ is smaller under the proposed social security system than under the existing one. From equation (11), it follows that pensions decline less rapidly under the new system than under the old. But this in turn implies that the average level of pension payments change as well. The direction of the effect is clear. Since P_{T^*} is unaltered, P_{T^*-1} must be smaller under the new system than under the old in order to ensure that dP_T/dT is closer to zero. Further, since retirement occurs later, if it changes at all, the benefits are reduced even more $(dP_T/dT < 0)$. In order to restore equilibrium, total compensation must rise to its previous level. There are two ways this can come about: an increase in the entire wage profile or an increase in P_{T^*}. An increase in the wage profile implies that $w(T) - v(T)$ falls so that the speed with which pensions fall as retirement is delayed will be reduced. If it takes the form of a rise in P_{T^*}, this is because the pension is used as a "lump sum" in order to make lifetime compensation equal to lifetime wealth.

To sum up: The effects on the pension plan are either: (a) P_{T^*} increases and the rate of decline in pension value for delayed retirement between $T^* - 3$ and T^* is reduced. (b) There is no change in P_{T^*}, and the rate of decline in pension value with delayed retirement between $T^* - 3$ and T^* is reduced to a lesser extent.

1. The Short Run

As before, it is interesting to consider what happens to workers already in the middle of their careers. Is there some way to change the pension/wage profile to make all workers better off and not harm the firm? Again, the proof that this cannot be done without distributional effects applies. To bring about efficiency, it is necessary to reduce the decline in pension value with retirement delayed to the normal age. This implies a higher pension cost, which could conceivably be financed by a lump-sum "tax" on all existing workers. The difficulty is that some workers benefit more than others by this change so that the policy implies distributional effects that cannot be undone without affecting efficient retirement.

D. Spread Out Ages Over Which Social Security Benefits Can Be Initiated

The final policy to be considered is a more gradual increase in benefits from early retirement to normal age. Suppose that the system were changed so that those who retired at age 62 received the same benefit flow under the new system as under the old, and that those who retire at 68 receive under the new system, the same annual benefits as those who retire at age 65 receive under the old system. This change leaves the expected present value of social security the same for retirement at age 62, but reduces it for retirement at any other age up to 68. Figure 8 illustrates the change.

At age 68, the flow is the same as it would have been at age 65 under the current system but the number of years over which those benefits are received is smaller. Between age 63 and 67, the flow of benefits is lower under the proposed system than under the current one so the present value is lower. For retirement at ages 68 and beyond, the two systems yield the same present value of benefits.

The effects of the change in policy on y depend again upon assumptions about capital markets. Both cases are examined. To start, assume that capital markets are perfect so that benefits always begin at the age which guarantees maximum present value. Figure 9 depicts y under the current and proposed situation.

This situation is virtually identical to Figure 6, which pertained to policy B, equal retirement flows deferred to older ages. The reason that y_1 has this shape is that under the assumption of perfect capital markets, workers all elect to begin receiving benefits at the normal age. But the maximum

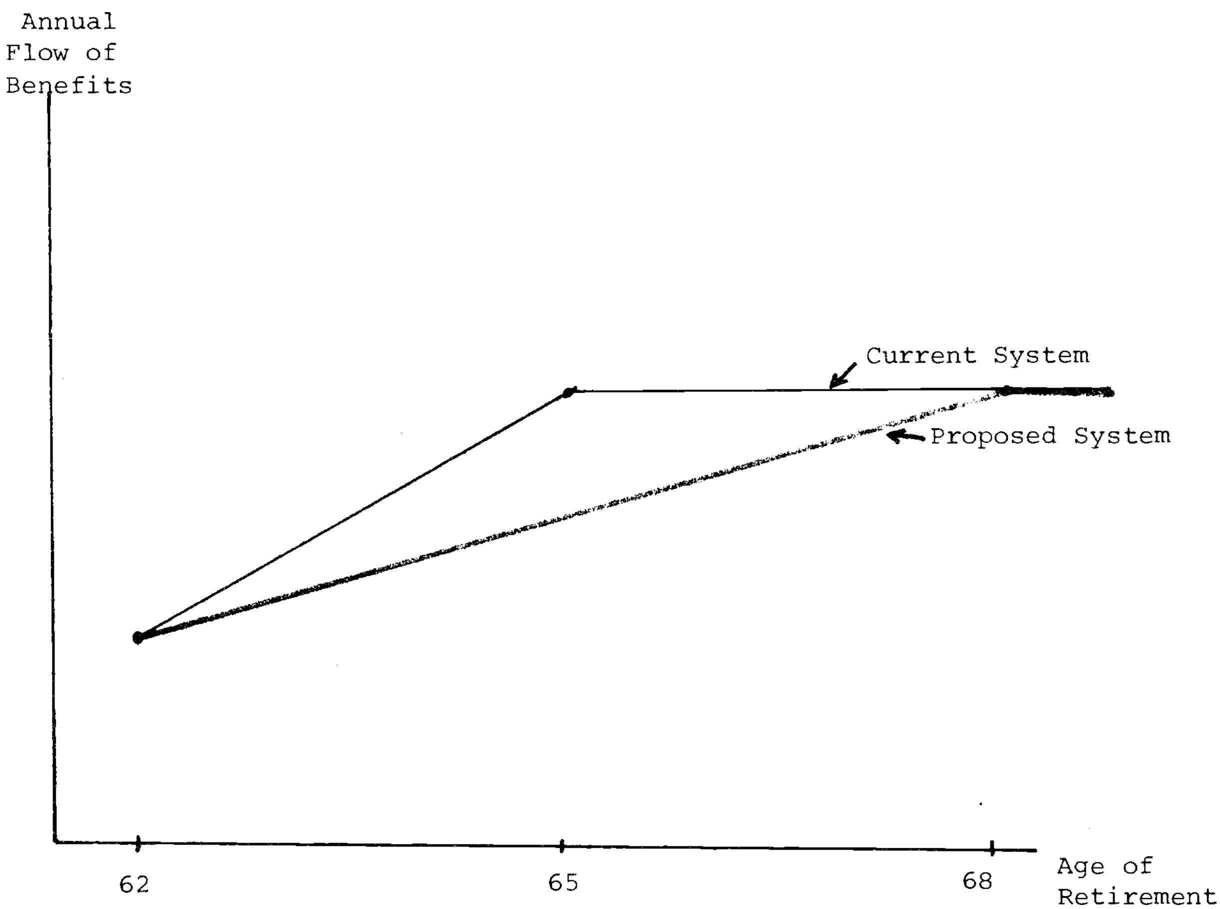
Annual
Flow of
Benefits
Current System
Proposed System
62
65
68
Age of
Retirement

Figure 8

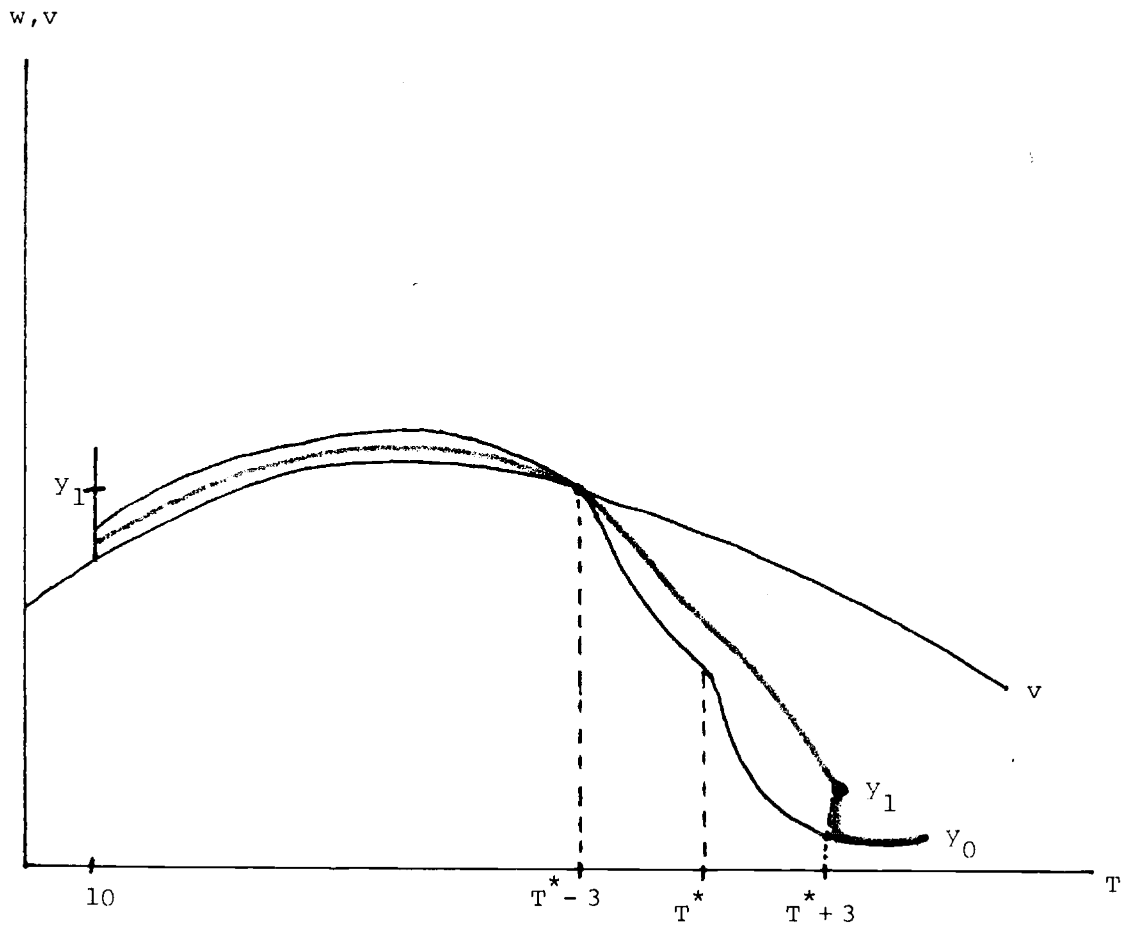

Figure 9

present value of benefits is smaller under the proposed system. If $S_{12} > 0$, then the y_1 deviates from v by less than does y_0. Additionally, the point at which the earnings test becomes relevant is age 68, rather than age 65, so the kink occurs later.

All implications are the same as in case B and need not be repeated here. Just to summarize, however, the main effect is that the present value of pension benefits are likely to be smaller at the new normal age of 68 than they were at the old normal age of 65. Additionally, the rate at which the present value of pension benefits declines with deferred retirement is lessened under the new system. Later average retirement occurs and there may be some indirect effects on the pension and wage paths.

The situation is quite different if workers can only consume what they earn in that period. Then, all workers begin retirement benefits at the earliest possible age, conditional upon retirement. This means that y_0 and y_1 are identical up to age 62 because retirement at any age on or before 62 induces the worker to begin benefits at that date. Since benefits at age 62 are the same under both systems, the paths converge as shown in Figure 10.

At $T^* - 3$, there is a kink upward in both the v_0^* and v_1^* functions. The reason is that present value of social security benefits increases with postponed retirement beyond that point until the normal age when the earnings test takes hold. That date is T^* under the current system and $T^* + 3$ under the proposed system. There is a kink downward at the normal age when the earnings test becomes binding.

The effects on optimal retirement depend upon the location of the value of leisure function. Those who would have retired before T^* under the current system are induced to retire earlier under the proposed system. But those who would have retired between 65 and 68 under the current system, post-

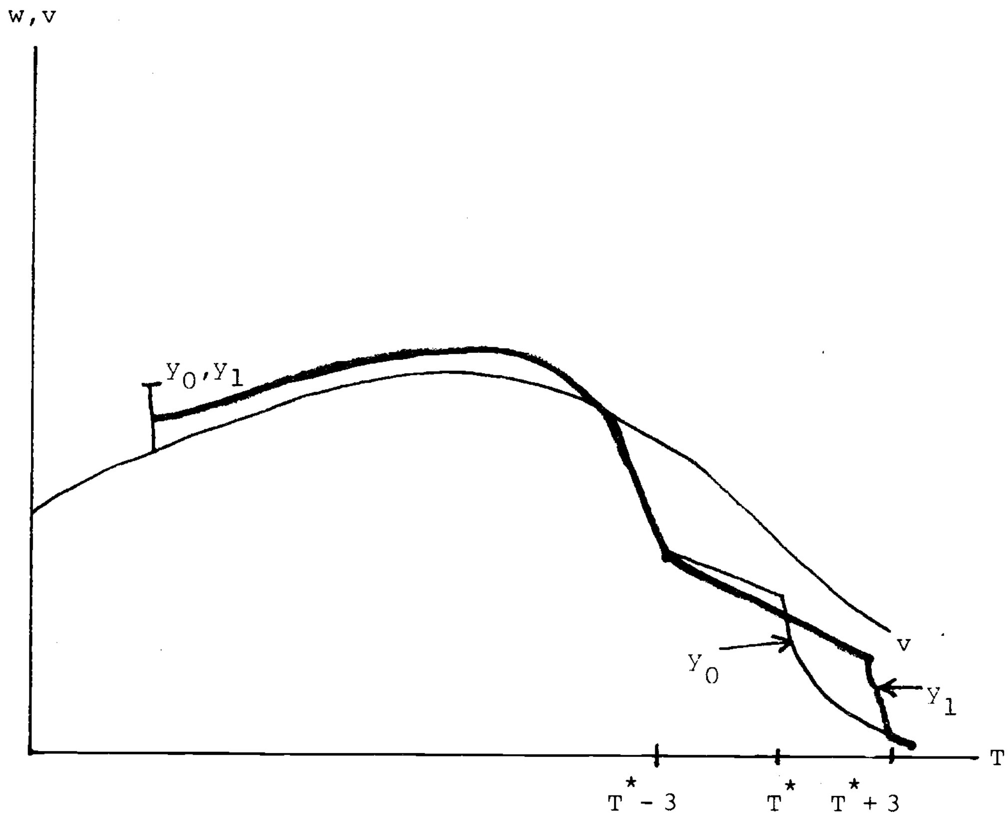

Figure 10

pone their retirement somewhat under the new system. The reason is that slowing down the accrual rate makes it more worthwhile to retire either toward the very beginning or toward the very end of benefit initiation dates, but reduces the value of retiring somewhere in the middle. Later retirement could imply higher costs to the social security system because the present value of benefits increases in age of retirement. But this effect is likely to be swamped by two other factors: First, some workers retire earlier and second, retirement at a given age implies lower benefits under the proposed system for many ages and benefits are never higher under the proposed system.

The effects on the pension system can be traced. First, the normal age of retirement for the purposes of pension determination is likely to move to a new modal age of 68. At that age, the present value of pension benefits is likely to be smaller than it was at age 65 under the current system because fewer years of life are left and there is little reason to expect the benefit flow to change from what it would have been at age 65. Additionally, $w - v$ is smaller between 65 and 68 so the rate at which pension value declines with retirement postponed beyond 65 will be smaller under the proposed system. (If anything $w_1(T) < w_0(T)$ for $T > T^* - 3$ because of a longer worklife and the constraint imposed by equation (13).) However, since $y_0 > y_1$ for $T^* - 3 < T \leq T^*$, the rate of decline in pension benefits with deferred retirement is greater under the proposed system. It is possible (although not necessary) that some very early retirees will receive higher pension benefits under the proposed system than under the current one. This situation is depicted in Figure 11. The expected present value of pension benefits under the current system is less than under the proposed system for retirement before age 68.

Whether these effects exactly balance to leave total pension payments unchanged is an empirical question. It seems likely, however, that the direct

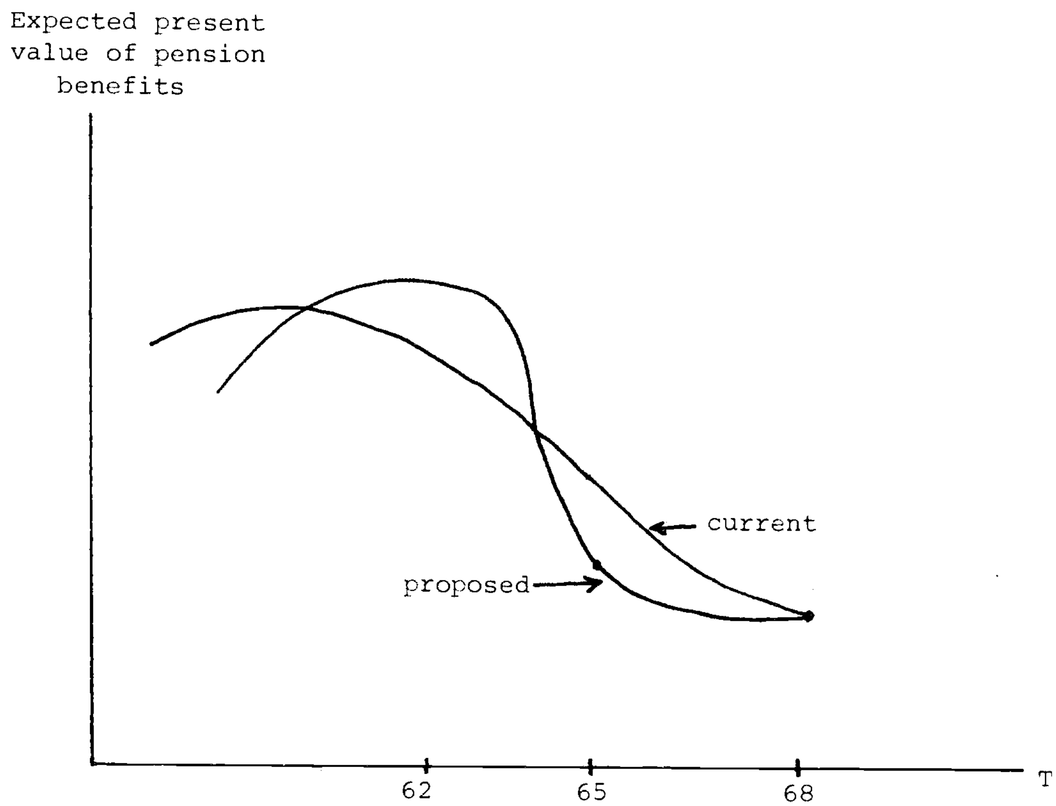
Expected present
value of pension
benefits
current
proposed
62
65
68
T

Figure 11

effects are to reduce the amount paid as pension to the workers. This may or may not be offset by wages that exceed marginal product during these final years. If all of these factors do not offset one another, then there will be some indirect effects on wage and pension paths, but it is impossible to predict the indirect effects.

To sum up, if workers can neither borrow nor lend, then the normal retirement age shifts to 68, at which point pensions are smaller in present value terms than they were under the old system at age 65. The pension accrual pattern changes to favor early retirement until age 65 when it switches, making postponed retirement more likely.

1. The Short Run

As before, distributional considerations prevent an unambiguous prediction on what will occur during the short run. The optimal policy is to make the pension value at age 68 less than it was before at age 65, but to change the relationship as shown in Figure 11. It is impossible to levy some tax on workers that leaves them all better off and still maintains (13). Depending upon that age of retirement, some workers are subsidized while others are penalized.

IV. Other Aspects of Pension Plans

A. Vesting

It is natural to consider whether the changes in the social security system are likely to have any effects on vesting. Although it is impossible to provide a definitive answer, most factors suggest that there will be little or no effect on vesting provisions. There are three reasons.

First, ERISA places some strict limitations on the nature of vesting. From an examination of the Bankers Trust (1980) study of corporate pension plans, it is not difficult to conclude that in large part, the ERISA prescription for vesting are the ones most frequently found in practice. Although ERISA may in large part have codified what already existed, to some extent deviant plans have been forced to conform to the ERISA standards. Unless ERISA provisions on vesting are changed at the same time as the social security system is changed, there is no reason to believe that legal changes will affect vesting.

Second, vesting is an event that occurs within the first ten, and at the latest 15, years of the worker's career. Retirement usually occurs well beyond that point. It is unlikely, therefore, that any changes in optimal retirement ages will bump up against vesting constraints.

Third, the role of vesting is often overstated. All that vesting normally does is allow the worker who quits to take with him the right to receive his currently accrued benefits when he reaches normal retirement age. This is not an important constraint for three reasons. First, since early retirement benefits are generally worth more than normal retirement benefits, and since vesting does not ensure the worker's right to receive early retirement benefits, separation affects the value of the accrued pension even with vesting. Second, accrual rates can be nonlinear, paying more for later years of service (after vesting) than for earlier years. Tilting the accrual path is a way to render the vesting constraint unimportant. Third, since the pension often depends upon final salary at that firm, quitting 10 to 20 years before retirement can leave the accrued benefits almost worthless in real terms, especially in an inflationary environment.

All of these considerations suggest that vesting rules are not likely to be affected by changes in the social security system.

B. Social Security Offsets

Perhaps the most immediate effect of a change in the social security structure on pensions workers through the social security offset provision. Many pension plans provide an implicit or explicit supplement for retirement that occurs before the age of social security entitlement. This supplement vanishes as soon as social security begins. These supplements are intended to smooth the flow of retirement income.

A number of the proposed policies considered in this analysis have provisions for social security payments that begin later and/or are smaller. Since most supplements are an inverse function of the social security payment, these changes imply a direct increase in pension payments for early retirement. Such an increase tends to undo much of what is desired as y changes.

As a result, one would expect the social security offset/supplement provisions to be rewritten. Although it is impossible to say what the exact nature of the rewrite would be, the following seems likely: If the purpose is to maintain the flow of retirement income constant, assuming that the worker begins receipt of benefits at the normal age,[6] then the supplement often will depend upon benefits received at age 68 rather than at age 65. However, if early retirement age is left unchanged, some workers will receive a larger total supplement than under the current situation. This increases the flow of pension benefits and must be offset in one of four primary ways. First, wages may fall over the early part of the life cycle. Since this causes other distortions, this is the least likely of the four. Second, the size of the annual early retirement supplement may be reduced. Some smoothing of post-retirement income is sacrificed if this method is adopted. Third, the age of

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[6]Some plans are based on benefits beginning at the earliest possible age.

early retirement may be increased so as to leave the total expected flow of early retirement benefits unchanged. Fourth, the average size of the pension payments at normal age can be reduced so that post-retirement income can be smoothed at the same original cost.

C. Other Provisions of Pension Plans

It is much more difficult to make conclusive statements about other provisions of pension plans including the age of early retirement, minimum and maximum years of service restrictions, and maximum age of starting employment beyond which no pension accrual occurs. The reason is that there is no good theory on why these provisions exist in the first place. An attempt to analyze them is continued in Lazear (1984), and to a lesser extent in Blinder (1982), but no satisfactory answers are given.

One possible way to treat these provisions is to assume that they are only dependent upon the normal age of retirement. If that age changes, the provisions change accordingly. For example, a change in the normal retirement age from 65 to 68 might shift the first age of early retirement from 55 to 58. But there is no compelling reason to assume that this is the way that provisions would be altered. As a result, nothing more is said on this issue.

V. Conclusion

Pensions vary a great deal and are quite complex, having many provisions that are not well understood by analysts. The necessary consequence of ignorance is a failure to be able to predict precisely the effect of a change in policy on pension formulas. Still, using a relatively simple formulation, this paper has provided a number of quite detailed predictions about the way that pension formulas are likely to change in response to changes in the social security rules. As such, it may provide a useful starting point for policy makers.

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