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PENSION BACKLOADING, WAGE TAXES, AND WORK DISINCENTIVES

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EXECUTIVE SUMMARY

The federal government is actively involved in encouraging the formation and growth of private pensions and in regulating their behavior. The primary form of encouragement is the government's tax subsidization of pensions. A primary attribute of pension plan provisions is an implicit tax on employment after certain ages. The primary form of pension regulation is through ERISA, the Employee Retirement Income Security Act. The government's involvement in encouraging and regulating private pensions appears to reflect its desire that workers have a secure source of old-age income that will lessen their reliance on Social Security. In recent years the government has reacted to demographic changes, their effects on Social Security funding, and the increase in early retirement by also using its pension and Social Security tax and regulatory policies to encourage workers to delay their retirement decision.

This chapter examines the structure of pension plans with two questions in mind. First, have government pension backloading regulations aimed at ensuring future pension benefits been effective? Second, has the structure of old-age pension accrual at the end of the workspan, an implicit tax,

greatly limited the effectiveness of government policy in reversing the trend to early retirement? The answers to these questions are important for assessing the benefits of the government's tax subsidization of pensions as they are currently structured.

Our principal findings are as follows:

1. ERISA regulations notwithstanding, a significant proportion of defined benefit plans exhibit severe backloading. Indeed, backloading is an inherent property of defined benefit pension plans.
2. A large fraction of defined benefit plans embed very substantial old-age work disincentives through an implicit tax on wage earnings.
3. These pension retirement incentives are often much greater than Social Security's retirement incentives.
4. Evidence from one large Fortune 500 firm indicates that pension retirement incentives can greatly increase the extent of early retirement.

1. INTRODUCTION

The federal government is actively involved in encouraging the formation and growth of private pensions and in regulating their behavior. The primary form of encouragement is the government's tax subsidization of pensions. Workers are taxed on their pension benefits not when they accrue but when they are received, at which time their tax brackets may be much lower. In addition, pension saving accumulates tax-free interest. The primary form of pension regulation is through ERISA, the 1974 Employee Retirement Income Security Act. The government's involvement in encouraging and regulating private pensions appears to reflect its desire that workers have a secure source of old-age income that will lessen their reliance on Social Security. In recent years the government has reacted to demographic changes, projected Social Security financial problems, and the increase in early retirement by adjusting somewhat its policies to encourage workers to delay their retirement decision. But, as yet, the government does not appear to have recognized the extent to which the provisions of private pension plans encourage early retirement.

This chapter examines the structure of pension plans with two questions in mind. First, have government pension backloading regulations aimed at securing workers their future pension benefits been effective? Second, has the structure of old-age pension accrual at the end of the workspan greatly limited the effectiveness of government policy in reversing the trend to early retirement? The answers to these questions are important for assessing the effects of the government's tax subsidization of pensions, as they are currently structured.

1.1 Government Concern with Pension Backloading and the Labor Supply of the Aged

Over the past two decades the government has been concerned with the backloading (delaying) of the accrual of vested pension benefits. Limiting the backloading of pension benefit accrual is an important objective of ERISA as well as subsequent legislation. The government's main concern with pension backloading, reflected in ERISA's vesting and minimum benefit accrual requirements, appears to be to ensure that older workers are not terminated, either intentionally or unintentionally, just in advance of accruing significant pension benefits. Senator Bentsen expressed this concern in introducing ERISA to Congress: "There are instances where workers have not received pension benefits that they have earned through years of long hard labor. Their dreams of financial security after retirement have been shattered." Although the legislation appears intended to limit the extent of backloading in defined benefit pension plans, it seems not to recognize that backloading is inherent in the benefit formulae of most defined benefit plans; it cannot be legislated away.

Another reason for concern about excessive pension backloading and, more generally, the pattern of pension benefit accrual involves retirement incentives. If most pension benefits accrue before a particular age, say the age of early retirement, beyond which additional accrual is negligible or possibly negative, workers will have an incentive to remain with the firm up to early retirement and then leave the firm. In effect, pension provisions often impose a tax on earnings after a particular age; wage earnings are offset by loss in pension wealth. This implicit tax could thus be a major explanation of the trend toward early retirement, a trend that the government is seeking to reverse through planned increases in the age at which Social Security benefits are received.

Although the backers of the ERISA legislation were apparently prompted by the potential avoidance of pension liabilities through layoff, backloading of pension accrual has much more general implications for worker mobility. Job change, by itself, reduces pension benefits. Even if it involves no change in future wage earnings and even if the provisions of the pension plans on the old and new jobs are the same, workers who change jobs will typically have much lower pension benefits at retirement age than those who remain with the same employer. Thus, pension provisions may inhibit worker mobility and, therefore, adjustment to changing economic circumstances.

The 1980s have witnessed a marked shift in government policy toward promoting the labor supply of the elderly. The government has virtually eliminated mandatory retirement and scheduled a gradual increase in

Social Security's retirement age. It has limited somewhat Social Security's earnings test that reduces Social Security benefits for "retired" workers earning more than an "exempt amount"; it has eliminated the earnings test after age 70 and is increasing the actuarial incentive to delay the receipt of Social Security benefits beyond age 65. The government has also required that pension plans provide continued pension benefit accrual for workers who remain with the firm beyond the pension plan's normal retirement age.

1.2 Demographic Change Meets the Trend Toward Early Retirement

The change in government policy toward the labor supply of the elderly is responsive to the major demographic swing currently underway, with its important implications for retirement finances in the next century. The elderly (those over 64), who now constitute about one-fifth of all adults, will constitute about two-fifths of all adults by 2040. Given Social Security's pay-as-you-go method of finance, the projected increase in the ratio of beneficiaries to contributors means either significant cuts in future benefits or significant future increases in Social Security's payroll tax rate. Although the 1983 Social Security legislation provides a plan for dealing with the baby boomer's demographic bulge, there is real concern that the plan will not be fully implemented; and if it is fully implemented, there is concern that it will not be sufficient.

Reversing the trend toward early retirement represents an important alternative for addressing the demographic transition. Additional labor supply of the elderly would relieve Social Security's finances as well as offset a potential shortage in the supply of labor relative to that of other productive factors. Despite recent changes in government policy, the early retirement trend remains quite strong. Table 1 presents the labor force participation rates of men between ages 40 to 64 since 1967. In 1967 the labor force participation rate of men aged 55 to 59 was 90.1 percent; it was 81.9 percent in 1980 and 79.0 percent in 1986. For males 60 to 64 the 1986 labor force participation rate was 54.9 percent, down from 61.0 percent in 1980 and 77.6 percent in 1967. The participation rate of men over 65 fell from 35 percent in 1960 to below 20 percent in 1980 (figures not shown in the table).

1.3 Are Pension Plans the Major Old-Age Work Deterrent?

Economists have pointed to Social Security as well as general increases in living standards as the key explanations for increased early retirement, but little attention has been given to the retirement incentives associated with

TABLE 1
Labor Force Participation Rates of Men

Year	Age				
	40–44	45–49	50–54	55–59	60–64
1967	97.0	96.2	94.2	90.1	77.6
1968	97.0	95.9	93.9	90.0	77.3
1969	96.7	95.7	93.5	89.6	75.8
1970	96.5	95.4	93.1	89.5	75.0
1971	96.3	94.9	92.8	88.8	74.1
1972	96.2	94.6	91.9	87.4	72.5
1973	95.8	94.3	91.7	86.2	69.1
1974	95.5	94.0	90.4	85.7	67.9
1975	95.2	94.1	90.1	84.4	65.7
1976	95.0	93.3	89.9	83.6	63.7
1977	95.3	93.2	89.2	83.2	62.9
1978	95.1	93.0	89.7	82.9	62.0
1979	95.3	93.4	89.6	82.2	61.8
1980	95.1	93.3	89.3	81.9	61.0
1981	94.9	93.4	89.6	81.3	58.7
1982	94.7	92.8	89.7	81.9	57.2
1983	94.8	93.3	89.1	80.7	57.0
1984	95.1	93.3	88.9	80.2	56.1
1985	94.7	93.3	88.6	79.6	55.6
1986	94.3	92.9	88.9	79.0	54.9

Source: Employment and earnings, various years.

private pension plan provisions. Our analysis of a recent Bureau of Labor Statistics cross-section survey of pension plans indicates a large proportion with substantially backloaded pension plans; these plans typically have very sizable accrual as the age of either early or normal retirement approaches, and they often have more lower, or even negative, pension accrual, thereafter. Such accrual profiles engender very large implicit taxes on labor supply beyond the age at which the significant pension accrual occurs. These old-age pension work disincentives often exceed those arising from the effect of Social Security provisions on Social Security accrual and from the effect of the Social Security earnings test. In addition to fostering early retirement, such accrual profiles raise the concern, voiced by Senator Bensten, that workers may be terminated, or change jobs for other reasons, immediately prior to accruing the great majority of their pension benefits.

1.4 Organization of the Paper

Before presenting the new evidence on pension backloading practices, we briefly discuss in the next section a possible economic rationale for pension backloading as well as the potential economic problems arising from the government's regulation of the pattern of pension accrual and, more generally, its anti-age-discrimination policy.

Section 3 introduces the concept of pension accrual and demonstrates how in many instances it imposes an implicit tax on wage earnings; sometimes it increases total compensation, and sometimes it reduces it. Illustrative graphs indicate that defined benefit pension plans are typically severely backloaded. Section 4 discusses ERISA's antibackloading rules and suggests why they are ineffective in limiting backloading. Section 5 presents findings on the accrual of pension benefits based on the 1979 Bureau of Labor Statistics Level of Benefits Survey (BLS-LOB). This survey of 1,469 establishments with 3,386,121 pension participants provides extremely detailed information concerning vesting, early and normal retirement benefits, supplemental early retirement benefits, and Social Security offset formulae, each of which is a crucial input to the calculation of pension accruals.

Section 6 examines the retirement response of workers in a large Fortune 500 company to the pattern of pension accrual. The pension accrual profile for this firm exhibits very substantial backloading with disproportionate benefit accrual at the age of early retirement and only modest accrual thereafter. This pension accrual profile appears to substantially increase the early retirement of the firm's employees. We estimate that the firm's accrual profile increases from 14 to 44 percent the probability that a worker at age 55 will leave employment prior to age 60. The last section briefly summarizes our findings and raises some questions relevant to pension policy.

2. AN ECONOMIC RATIONALE FOR PENSION BACKLOADING

In recent years the traditional spot-market view of the labor market, in which compensation equals productivity at each point in time, has given way to a contract view. According to the contract view, workers and firms enter into long-term relationships, which may be explicit or implicit, in which there is a relationship over time between compensation and productivity but not necessarily an equality between the two at any given point in time.

The economic rationale for long-term labor contracts as opposed to short-term spot-market arrangements is that firms can structure compensation over the workspan to improve worker incentives. For example, by paying workers for less than they produce when young and for more than they produce when old, the firm provides the worker with an enhanced incentive to remain with the firm. It may also provide an incentive to work harder; the cost of shirking becomes not only the loss of one's current salary but also the lost opportunity to earn more than one produces in the future. This carrot-stick age-related structure of compensation is potentially beneficial not only to employers but to workers as well. By reducing worker turnover and increasing effort, the firm can afford to pay workers a higher present value of compensation. Such higher present-value payments to workers reflect not the benevolence of employers but the outcome of a competitive contract market in which firms compete with each other in hiring workers.

Although the long-term contract view of labor arrangements implies that the firm will compensate the worker in excess of his or her productivity after an initial period in which the reverse is true, the length of time during which compensation exceeds productivity cannot be unlimited. The firm's competitive interest is in reimbursing the worker when old for earning less than he or she produced when young, not paying the worker more than is necessary to balance the account. Hence, the firm's interest is in fixing the length of time in which compensation exceeds productivity. As pointed out by Lazear (1981,1982), mandatory retirement provides a convenient mechanism for limiting this time period.

Compensation can be paid as wage earnings or as pension accrual. Therefore, one mechanism for paying deferred compensation at certain ages and for reducing compensation at subsequent ages is to provide significant positive pension accrual prior to a critical age and small or even negative pension accrual thereafter.

In eliminating mandatory retirement the government may have reduced one important mechanism by which employers were able to limit the amount of deferred compensation. If Congress were also to proscribe abrupt changes in the age-profile of pension or any other form of compensation, firms might find it even more difficult to structure deferred compensation efficiently.

In addition to potential assistance in providing work incentives, the age profile of pension accrual may represent a graceful mechanism to lower the wages of older workers if, as seems likely (Kotlikoff (1987)), they become less productive with age. As described below, pension accrual after early and/or normal retirement ages is often quite small, if not negative.

3. PENSION BENEFIT ACCRUAL FORMULAE AND IMPLICIT TAX ON WAGE EARNINGS

Vested pension benefit accrual at age a, $I(a)$, equals the difference between pension wealth at age $a+1$, $Pw(a+1)$, and pension wealth at age a, $Pw(a)$, accumulated to age $a+1$ at the nominal interest rate r: that is,

$$I(a) = Pw(a + 1) - Pw(a)(1 + r). \tag{1}$$

Pension accrual is thus the increment to pension wealth in excess of the return on the previously accumulated pension bank account. Pension wealth at age a is defined as the expected value of vested pension benefits discounted to age a. The term "expected" refers to the use of mortality probabilities to assess the chances that the worker will be alive at future ages when benefits are available. Intuitively, $Pw(a)$ can be thought of as the worker's pension bank account. If $I(a) = 0$, the worker continuing employment with the plan sponsor at age a has exactly the same pension wealth at age $a + 1$ as an identically situated worker who terminates employment at age a. The worker receives no compensation in the form of increased future pension benefits.

Figure 1 presents the age profile of accrued pension benefits divided by wages for a hypothetical plan under different assumptions about real wage growth and nominal interest rates. The top profile, for example, is based on a 3 percent rate of real wage growth and a 9 percent nominal interest rate. The inflation rate assumed in each profile is 6 percent. The plan provides 100 percent vesting at ten years of service and calculates normal retirement benefits as 1 percent of average earnings over the last five years of service times the number of years of service. The plan's early and normal retirement ages are 55 and 65, respectively. Workers can retire early and receive early retirement benefits that equal normal retirement benefits reduced by 3 percent for each year that retirement precedes the normal retirement age.

There are two significant discontinuities in the profiles. One occurs at age 40 when the worker becomes vested; clearly in going from age 39 to age 40 the worker's vested pension wealth changes abruptly from zero to a positive number explaining the jump in the profile. The second discontinuity occurs at the age of early retirement. It arises because the 3 percent per year early retirement reduction factor is much more generous than an actuarial reduction. By retiring a year earlier, the worker gains a year's benefit with only a modest, 3 percent, payment for that delay. To understand more clearly why there is a discontinuous fall in pension
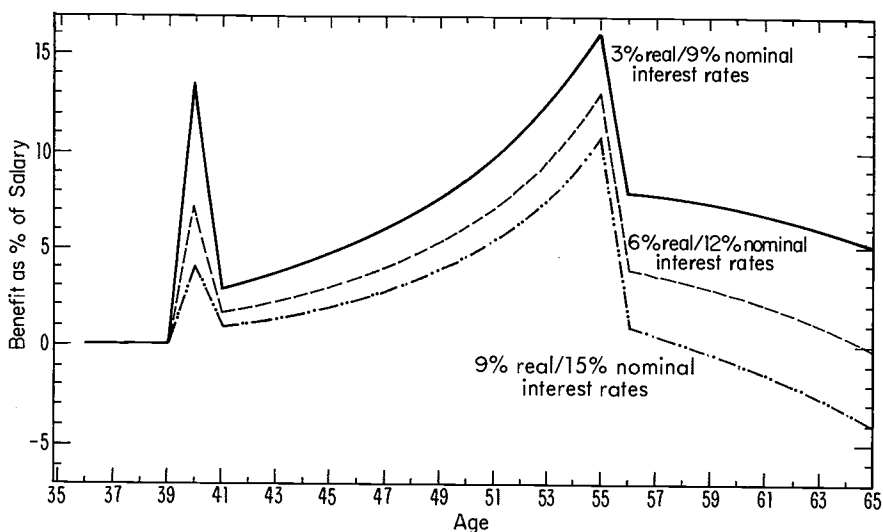
FIGURE 1. *Pension increments as a percentage of salary, by age, for a wage stream with 6 percent inflation discounted at real interest rates of 3 percent, 6 percent, and 9 percent.*

accrual at early retirement, consider the case in which the early retirement reduction factor is zero. In this case by working an additional year after age 55, the worker loses that year's benefit entirely. Although it is true that the worker's future benefit will likely be larger because of an additional year of service and possibly an increase in the earnings base, the loss of this year's benefit may significantly offset or even outweigh, in present value, this benefit increase, implying a small or negative pension accrual during the period after early retirement.

The diagram indicates roughly a halving in the accrual ratio between ages 55 and 56. Beyond age 55 the accrual ratio declines gradually. If one assumes a sufficiently high interest rate, the accrual after age 55 is negative. According to the three curves, total compensation is roughly 8 percent lower, ceteris paribus, at age 65 than at age 55. The diagram also indicates that much of the accrual of vested pension benefits occurs in the ages immediately preceding age 55. Figure 2 shows the effect of the lower-than-actuarial reduction for early retirement on the hypothetical plan's accrual profile. It compares the top profile of Figure 1 with the profile that would occur if the reduction factor were actuarial or, what is equivalent, if workers were forced to wait until the normal retirement age to collect benefits. Notice that the discontinuity at age 65 disappears. Also note that the
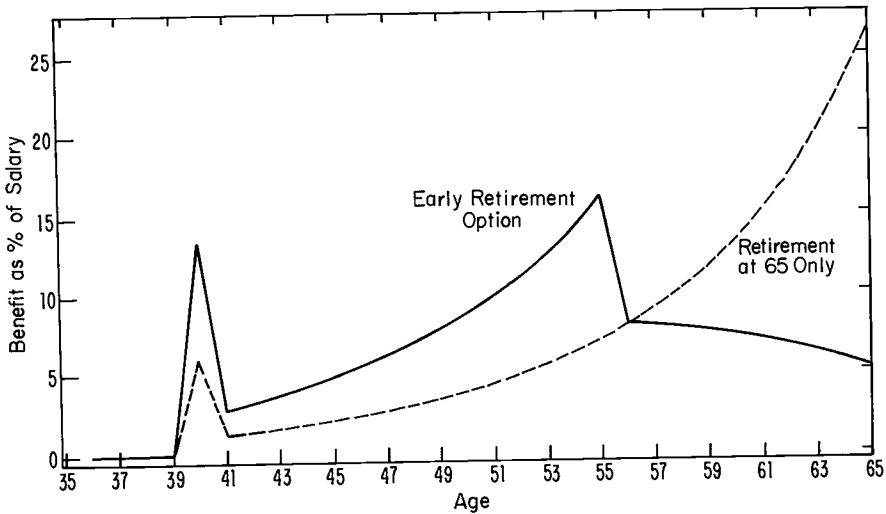
FIGURE 2. *Pension increments as a percentage of salary, by age, for plans with an early retirement option versus retirement at 65. 6 percent wage inflation, 3 percent real interest rate.*

backloading in the "Retirement at 65 Only" profile is even greater than that in the profile with the early retirement option. This is inherent in the defined benefit formula, with the benefit at age a typically given by $B(a) = kW(a)T(a)$, where $W(a)$ is the wage at age a, $T(a)$ is years of service at age a, and k is a multiplier often between 0.01 and 0.02. If $k = 0.02$, the worker's benefit, in nominal dollars, is 2 percent of his final wage for each year of service; after working thirty years, the pension would equal 60 percent of the final wage.

3.1 The Accrual Profile for a Large Fortune 500 Firm

The profiles presented in the first two diagrams, although indicative of a considerable degree of backloading, are based on a hypothetical plan with rather simple features. But if one thing is true of private pension plans, it is that there is enormous variation among them. Figure 3 presents the pension accrual profile of male managers hired at age 20 in the Fortune 500 firm whose retirement behavior is discussed in Section 6. The diagram also includes the estimated age-wage profile in absolute 1985 dollars for the managers as well as the age-accrual profile of Social Security benefits.

In addition to having ten-year "cliff" vesting, a two-step earnings-related normal retirement benefit formula, this plan has a Social Security offset, a supplemental early retirement benefit, and special early retirement benefit

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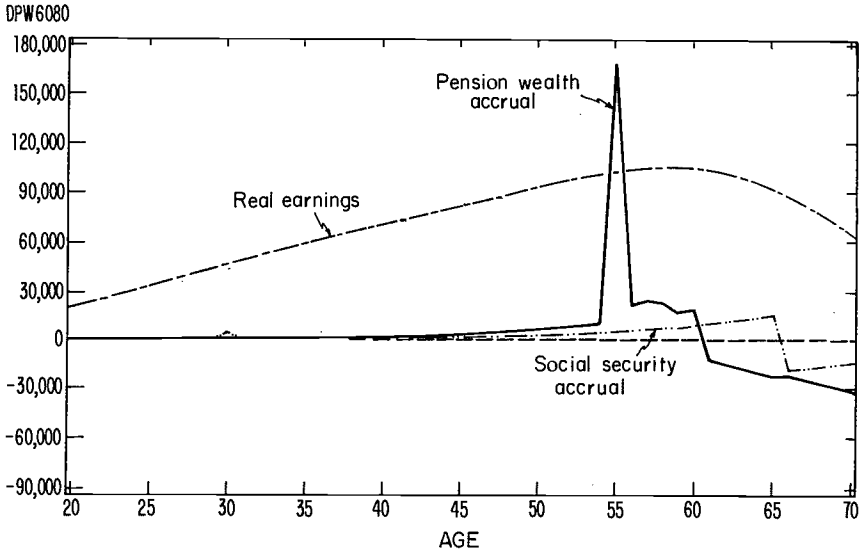
FIGURE 3. *Pension wealth accrual, SS accrual, and wage earnings for male managers born in 1960 and hired in 1980, in real 1985 dollars.*

reduction factors. The supplemental early retirement benefit and the less-than-actuarially fair reduction factors are available only to workers who remain with the firm through age 55, the early retirement age. Workers who leave at age 54 or earlier can start collecting their vested benefits at age 55, but these benefits are actuarially reduced. In addition, such pre–early retirement terminators receive benefits that are immediately reduced by the Social Security offset. In contrast, for workers retiring at age 55 or later, the Social Security offset does not occur until age 65; hence, the supplemental early retirement benefit corresponds to the Social Security offset for each year between the age of retirement and age 65.

Thus there are two important reasons for the accrual spike at early retirement in Figure 3. The first is the nonactuarial early retirement reduction factors and the fact that they are available only to those remaining with the firm until age 55; the second is the delay in the Social Security offset, which is also only provided to workers remaining through early retirement.

Now that we understand the source of the large accrual spike in Figure 3, let us consider its size and implications. First the spike at age 55 is very large—over one-and-one-half times a year's earnings. Second, between age 55 and 60, accrual, though small in comparison with the spike at 55, is still

quite important. However, after age 60 accrual is negative, becoming significantly negative by age 65. Clearly, this is an extremely backloaded pension plan that provides workers with a strong incentive to remain with the firm through early retirement and a strong incentive to leave the firm thereafter. For workers who quit or otherwise lose their jobs at, for example, age 54, there is a very substantial loss in benefits compared with remaining on the job through age 55. In its effect accrual profiles of this kind recreate the situation of some plans prior to ERISA in which workers *could* be terminated immediately before they accrued the bulk of their potential pension benefits. There is clear evidence that this does not happen in this firm, however.

4. HOW FIRMS MAY CIRCUMVENT ERISA'S ANTIBACKLOADING RULES

ERISA stipulates that defined benefit pension accrual must satisfy one of three provisions. The first is a 3 percent rule that says that workers' accrued benefits must exceed their years of service times 3 percent of the normal retirement benefit they would have if they had begun service at the earliest possible age of participation and had remained with the firm until normal retirement. That is, for each year of employment pension, accrual must be at least 3 percent of the amount the workers will have if they stay until normal retirement. The second provision is a 133 percent rule that says that future projected annual pension accrual cannot exceed 133 percent of current annual pension accrual. The third provision stipulates that the terminating worker's benefit be not less than his or her projected normal retirement benefit times the ratio of actual completed service to the service the worker would have if he or she remained with the firm through early retirement. That is, if the worker leaves after twenty years and normal retirement would be after forty years, the benefit must be 50 percent of what the worker would have if he or she worked twenty more years.

   Each of these three provisions specifies that the projection of future normal retirement benefits and future pension accrual be determined by assuming that a worker's future wage equals the current wage. But if there is wage inflation, future wages may be much greater than current wages, and the real value of current accrual may be quite low. Thus even a modest rate of wage inflation could permit a quite backloaded plan that, nonetheless, meets one of the three antibackloading provisions. The choice of other assumptions in the accrual calculation, such as the interest rate, also give firms additional latitude in deferring pension accrual.

   However, the main method of backloading that does not appear to be

ruled out by the three ERISA rules involves early retirement provisions. The accrual rules pertain to normal retirement benefits rather than early retirement benefits. Extra benefits arising from supplemental early retirement benefits or from less-than-actuarial reductions of early retirement benefits do not appear to be considered in the three antibackloading rules. Thus a firm could structure its plan to have small normal retirement benefit but to have substantial early retirement benefit, for example. It could easily conform its accrual of the small normal retirement benefit to one of the three ERISA rules, yet remain free to specify quite large early retirement benefits that only accrue if the worker stays with the firm through a critical age. Recall the example of the large firm considered here; this firm provides extra early retirement benefits in the form of (1) a waiver until the age of normal retirement in their offset of benefits due to Social Security and (2) less-than-actuarial early retirement reduction rates.

5. PENSION ACCRUAL IN THE BLS-LOB DATA

In this section we examine accrual ratios for earnings-based defined benefit plans from the BLS-LOB survey. Earnings-based plans account for approximately 80 percent of BLS-designated usable plans from the survey and about 65 percent of plans weighted by pension coverage. Each of the earnings-based plans we examine stipulates cliff vesting at ten years, but the plans have different normal and early retirement ages. Other earnings-based plans with different vesting ages have accrual profiles similar to those that we shall describe, but for convenience of exposition we have not included them in our analysis here. Of the 1,183 earnings-based plans we examine, 508 are integrated with Social Security under an offset formula. The accrual profiles were calculated under the assumption of a 6 percent nominal wage growth up to age 65, after which nominal wage growth is assumed to be zero. We also assume a 9 percent interest rate. Our calculations are based on the industry-occupation-age-earnings profiles reported in Kotlikoff and Wise (1987).

5.1 The Decline in Pension Wealth Accrual at Early and Normal Retirement Ages

Age profiles of the average ratio of pension accrual to the wage for the percent of earnings plans with ten-year cliff vesting are shown in Table 2 by early and normal retirement ages. Three of these average profiles, corresponding to plans with the respective early and normal retirement ages— 55–55, 55–65, 65–65—are graphed in Figure 4. The 55–55 and the 65–65 profiles show a considerable degree of backloading, the first with dispro-

TABLE 2

Weighted Average Accrual Rates for Percent of Earnings Plans With Ten-Year Cliff Vesting, by Early and Normal Retirement Age[a]

Early ret.	55	55	55	60	60	62	62	65
Normal ret.	55	60	65	60	65	62	65	65
No. of plans	152	115	513	78	53	19	8	50
Age								
40	.244	.111	.071	.034	.047	.038	.054	.036
41	.045	.022	.013	.007	.010	.016	.009	.010
42	.051	.026	.016	.008	.011	.017	.010	.011
43	.058	.029	.018	.010	.013	.120	.011	.012
44	.066	.033	.020	.011	.015	.029	.013	.014
45	.075	.036	.023	.013	.017	.036	.013	.016
46	.085	.043	.026	.016	.019	.042	.015	.018
47	.097	.050	.031	.028	.022	.047	.017	.021
48	.110	.057	.035	.039	.025	.054	.019	.024
49	.124	.064	.040	.056	.029	.060	.021	.027
50	.141	.077	.046	.065	.034	.068	.023	.031
51	.159	.072	.052	.084	.040	.077	.026	.033
52	.180	.087	.062	.091	.050	.090	.028	.043
53	.204	.099	.072	.105	.060	.101	.032	.050
54	.231	.113	.083	.117	.068	.114	.035	.055
55	.261	.130	.097	.149	.082	.128	.039	.065
56	−.003	.100	.068	.170	.094	.144	.036	.068
57	−.012	.111	.072	.192	.107	.162	.039	.076
58	−.020	.118	.076	.224	.127	.184	.044	.089
59	−.028	.129	.077	.241	.146	.208	.048	.105
60	−.038	.143	.079	.269	.167	.241	.054	.118
61	−.048	−.090	.068	−.061	.113	.220	.059	.128
62	−.058	−.091	.064	−.091	.115	.248	.066	.145
63	−.067	−.091	.056	−.114	.114	−.130	.017	.163
64	−.076	−.092	.053	−.121	.114	−.136	.012	.186
65	−.085	−.094	.044	−.121	.112	−.144	.006	.211
66	−.292	−.169	−.152	−.138	−.088	−.266	−.081	−.194
67	−.294	−.174	−.162	−.155	−.115	−.263	−.080	−.204
68	−.295	−.179	−.171	−.171	−.142	−.260	−.079	−.213
69	−.296	−.182	−.179	−.184	−.162	−.258	−.078	−.221
70	−.297	−.184	−.186	−.196	−.182	−.255	−.077	−.234

[a] Plans with early or normal retirement supplements are excluded.

Plans with early or normal retirement supplements are excluded
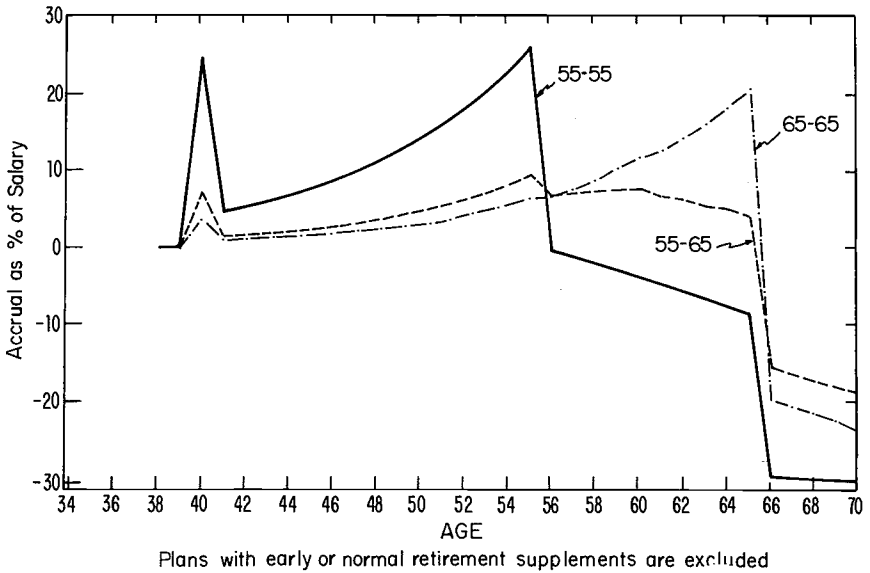
FIGURE 4. *Weighted average accrual rates for percentage of earnings plans with ten-year cliff vesting, for selected early and normal retirement ages.*

portionate accrual as age approaches 55, and the second as age approaches 65. In addition, each graph shows substantial declines in the rate of pension wealth accrual at several critical ages. The first is the age of normal retirement, which equals the age of early retirement for plans with no early retirement option. Second, there is a sharp decline in the rate of accrual at the age of early retirement, but this decline is substantially lower than the decline at the normal retirement age. Third, there is a very substantial decline between ages 65 and 66 in the average accrual rate no matter what the ages of early and normal retirement. This age 65 decline would, however, be smaller under current law, which mandates continued participation in the plan's benefit formula after the plan's normal retirement age. This 1986 legislation was not incorporated in these accrual analyses because the law postdates our information on the pension plans. The new law may have temporarily altered the postnormal retirement accrual pattern. But, if the patterns depicted here were chosen for a specific reason, and there is little evidence that they were or that they were not, plans could add additional features that will restore the pre-1986 decline in pension accrual after normal retirement.

The declines in average accrual rates at the critical ages indicated in Table

TABLE 3

	(1) 55 55	(2) 55 60	(3) 55 65	(4) 60 60	(5) 60 65	(6) 62 62	(7) 62 65	(8) 65 65
Age			*Early and normal retirement age*					
40	.244	.111	.071	.034	.047	.038	.054	.036
55	.261	.130	.097					
56	−.003	.100	.068					
60		.143		.269	.167			
61		−.090		−.061	.113			
62						.248	.066	
63						−.130	.017	
65	−.085	−.094	.044	−.121	.112	−.144	.006	.211
66	−.292	−.169	−.152	−.138	−.088	−.266	−.081	−.194
70	−.297	−.184	−.186	−.196	−.182	−.255	−.077	−.234
65–66	20	8	19	2	20	12	8	40

2 are highlighted in Table 3. The ages of early and normal retirement are identical in columns 1, 4, 6, and 8 of the table with respective retirement ages of 55, 60, 62, and 65. At these ages the accrual rate as a percentage of wages declines from 0.26 to 0, 0.27 to 0.06, 0.25 to −0.13, and 0.21 to −0.19, respectively. Thus, total annual compensation (wage plus pension accrual) from working declines at these ages by 21 percent, 26 percent, 30 percent, and 33 percent, respectively. Surely the incentive beyond these ages to continue work with the current employer is substantially reduced.

In instances where early and normal retirement ages do not coincide, there is also a substantial decline in the average ratio of pension accrual to the wage at the age of normal retirement. For example, among plans with early retirement at 55 and normal retirement at 60, the average decline is from 0.14 to −0.09. There is also a decline at the age of early retirement for these plans, although it is considerably less than the decline at the age of normal retirement. For example, of plans with early retirement at 55 and normal retirement at 65, the average decline at 55 is from 0.10 to 0.07, whereas at 65 the average decline is from 0.04 to -0.15.

The figure and the table also show a large variation in average pension accrual at 40, the age of cliff vesting. It is highest, on average, for plans with early and normal retirement at 55 and lowest, on average, for plans with early and normal retirement at 65. As mentioned, because the early retirement reduction is typically less than actuarially fair, pension wealth—the present value of the future stream of benefit payments—is generally greatest if benefits are taken at the age of early retirement. Thus the accrued
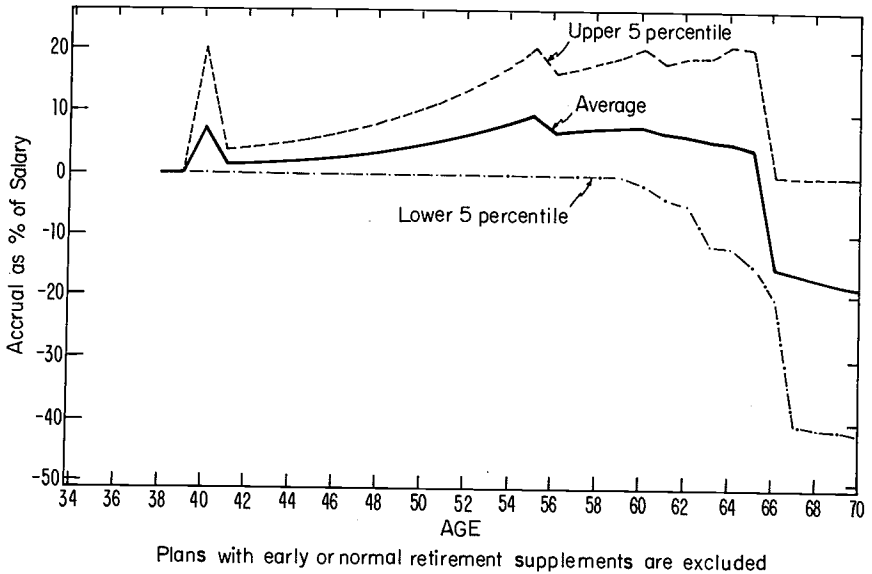
FIGURE 5. *Weighted average accrual rates and upper and lower 5 percentile levels for percentage of earnings plans with ten-year cliff vesting. Early retirement at 55, and normal retirement at 65.*

wealth at the age of vesting is usually calculated by discounting benefits from the age of early retirement, assuming that the worker could begin to collect benefits at that age. Figure 4, for example, shows an average vesting spike of almost 25 percent of earnings for 55–55 plans, 7 percent of earnings for 55–65 plans, and about 4 percent of earnings for 65–65 plans.

5.2 Variation Among Plans

Even among plans with the same early and normal retirement ages there is wide variation in accrual rates at each age, particularly after the age of early retirement. Consider the accrual ratio at age 55. The average ratio for this subsample is 0.097, the maximum is 0.405, and the minimum is 0. The ratio at the lowest fifth percentile is 0, at the highest fifth percentile it is 0.208. There is a similarly large dispersion in annual accrual ratios at each of the ages 40 through 70. Weighted average accrual rates together with upper and lower 5 percentile levels are graphed in Figure 5. The average accrual rates between ages 55 and 65 are positive; for many plans, however, the rates prior to age 65 are very negative. *Thus it is very important not to base judgments about the labor force participation incentive effects of pensions simply on the basis of average accrual rates.*
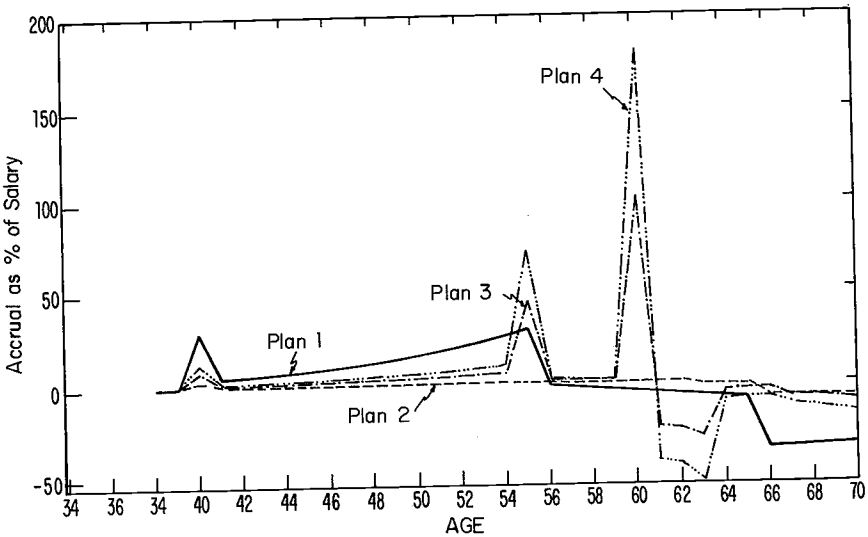
FIGURE 6. *Accrual profiles for four large plans.*

Additional evidence of the variability of pension accrual profiles and the possibility of severely backloaded plans is obtained by comparing profiles of particular plans. Figure 6 plots the accrual profiles of four of the sample's largest plans. Plan 1 exhibits a 29 percent vesting spike, a reduction of 30 percentage points in the accrual ratio at age 55 and a further major reduction at age 65 from −0.063 to −0.351. In contrast, the vesting spike is only 4 percent for plan 2 in the figure. This plan also exhibits no major reduction in the accrual ratio after early retirement and only a minor reduction at normal retirement. Plan 3's vesting spike is much less than that of plan 1, but the drop in accrual at age 55 is very much larger than that in plan 1. This plan also exhibits extremely sharp changes in accrual ratios at ages 60 and 63. Plan 4 exhibits even greater discontinuities in the accrual profile and more backloading than Plan 3. It shows little accrual before age 55, accrual at 55 equivalent to about 75 percent of the wage, little accrual at ages 56 through 59, accrual at 60 almost twice as large as wage earnings, then *negative* accrual at ages 61 through 63 equivalent to about 50 percent of the wage. Clearly, the plans' incentive effects on labor force participation also vary widely.

5.3 Accrual Ratios by Industry and Occupation
Holding fixed the early and normal retirement ages, we see little difference in average accrual profiles across industries or occupations. But since these

retirement ages differ, on average, particularly across industries, a typical worker faces a much greater incentive in some industries to leave the labor force early. For example, a large proportion of workers covered by pensions in transportation would experience a 27 percent reduction in effective compensation by continuing to work between 55 and 56. At 55, pension accrual would be equivalent to about 27 percent of wage rates for many workers in this industry, but if the worker continued in the labor force until age 66 the annual loss in pension wealth would be equivalent to 30 percent of wage earnings at 66. A large proportion of workers in manufacturing have plans with early retirement at 55 and normal retirement at 65. In this case, the accrual at 55 averages about 9 percent of the wage at 55 and only declines to about 7 percent of the wage by 65. But then the accrual rate becomes negative, and if the worker were to continued in the labor force between 65 and 66 the decline in pension accrual would amount to an effective reduction in compensation of about 21 percent.

5.4 The Possible Impact of the 1986 Age Discrimination Act on Pension Accrual

Table 4 isolates the potential impact of the 1986 legislation requiring continued participation in the pension formula after the plan's normal retirement age. The table presents the accrual ratios for percentage of earnings plans with early retirement at 55 and selected normal retirement ages calculated by first assuming that all of the plans had a provision to credit fully postnormal retirement service and second by assuming that all the plans had no such credit provision. The table indicates that the effect of crediting service after normal retirement depends importantly on the age of normal retirement. For plans with a normal retirement age of 55, negative accrual ratios are larger in absolute value under no crediting prior to age 66 and smaller in absolute value thereafter. A similar pattern, although less pronounced, is observed after age 62 for plans with normal retirement at that age. The least effect is found for the most common plans, those with normal retirement at 65 (and early retirement at 55). If pension plans do not alter some other features to reproduce the pre-1986 retirement incentives, the 1986 legislation will have a nontrivial affect on retirement incentives for some plans at some ages. But even if plans are not restructured, fully crediting postnormal retirement service has only a minor impact on accrual after age 66 for most pension plans.

5.5 Early and Normal Retirement Supplements and the Potential for Backloading

Approximately 11.4 percent of plans have early retirement supplements, and 7.5 percent have normal ones. The typical normal retirement supple-

TABLE 4
Weighted Average Accrual Rates for Percent of Earnings Plans With Ten-Year Cliff Vesting and Early Retirement at 55, by Normal Retirement Age, Assuming Full Credit and No Credit Postretirement Provisions

Normal ret.	55 FC[a]	55 NC	62 FC	62 NC	65 FC	65 NC
No. of plans	152	152	187	187	513	513
Age						
40	.244	.244	.106	.106	.071	.071
41	.045	.045	.023	.023	.013	.013
42	.051	.051	.027	.027	.016	.016
43	.058	.058	.032	.031	.018	.018
44	.066	.066	.035	.035	.020	.020
45	.075	.075	.045	.045	.023	.023
46	.085	.085	.046	.046	.026	.026
47	.097	.097	.055	.055	.031	.031
48	.110	.110	.064	.064	.035	.035
49	.124	.124	.076	.076	.040	.040
50	.141	.141	.090	.090	.046	.046
51	.159	.159	.104	.104	.052	.052
52	.180	.180	.120	.120	.062	.062
53	.204	.204	.140	.140	.072	.072
54	.231	.231	.160	.160	.083	.083
55	.261	.261	.185	.185	.097	.097
56	−.002	−.244	.102	.102	.068	.068
57	−.011	−.229	.105	.105	.072	.072
58	−.019	−.215	.118	.118	.076	.076
59	−.027	−.202	.117	.117	.077	.077
60	−.037	−.139	.114	.114	.079	.079
61	−.049	−.178	.099	.099	.068	.068
62	−.059	−.167	.098	.098	.064	.064
63	−.068	−.157	−.060	−.284	.056	.056
64	−.077	−.148	−.069	−.267	.053	.063
65	−.086	−.139	−.079	−.252	.044	.044
66	−.133	−.130	−.150	−.237	−.132	−.225
67	−.177	−.128	−.192	−.233	−.153	−.222
68	−.219	−.127	−.231	−.232	−.172	−.219
69	−.261	−.124	−.260	−.227	−.190	−.216
70	−.301	−.123	−.285	−.223	−.205	−.212

[a] Assumed postnormal retirement provision: FC = full credit; NC = no credit.

ment provides an addition to otherwise calculated benefits if the individual postpones retirement until the normal retirement age. The typical early retirement supplement provides an addition to benefits if retirement occurs after the age of early retirement. Retirement supplements, which are not available to workers who leave before reaching specified ages, thus provide a potentially powerful mechanism for pension backloading.

The average accrual rates for percentage of earnings and flat plans with supplements, with ten-year cliff vesting, and with early and normal retirement at 55 and 65, respectively, are shown in Table 5 by type of supplement. There are just two plans in the category with only normal retirement supplements, but, nonetheless, the effect of the supplements can be seen in the first column of the table. The accrual rate jumps from about 8 percent of the wage at age 64 to 60 percent of the wage at age 65. Thus the supplement generates substantial backloading and provides a relatively strong incentive to remain with the firm until age 65, but thereafter there is a sharp drop in the accrual rate to -18 percent.

Accrual rates for plans with early retirement supplements are shown in the second column of the table. In this case there is a sharp increase in the average accrual rate from 12 percent of the wage at age 54 to 44 percent at age 55, with a sharp drop thereafter. Again, the provision increases backloading and provides a substantial incentive to remain with the firm until the age of early retirement, with a very substantial disincentive to remaining thereafter. Accrual rates for plans with both types of supplements are shown in the last column of the table. In this case there is a rather large spike at the age of early retirement, equal to 62 percent of the wage in that year, with a smaller, but still noticeable, spike at about the age of normal retirement.

Accrual rates for percent of earnings and flat plans with either type of supplement are shown in Table 6 for selected early and normal retirement ages. The spikes in the accrual rates are highlighted with dashed lines. Consider, for example, plans with early retirement at age 55. The spike created by the early retirement supplement is from 0.22 at age 54 to 0.39 at age 55 for plans with normal retirement at 55, from 0.12 at age 54 to 0.50 at age 55 for plans with normal retirement at 60, and from 0.11 at age 54 to 0.48 at age 55 for plans with normal retirement at 65. Of the 56 plans with normal retirement at age 60, the pension accrual rate at that age is, on average, equivalent to 100 percent of the wage rate.

Similar discontinuities in the accrual ratios are evident for plans with other early and normal retirement ages. For example, of plans with early and normal retirement at age 60, the accrual rate at that age is equivalent to 64 percent of the annual wage for persons aged 60. Thus these special supplements create very significant one-time additions to pension wealth

TABLE 5
Weighted Average Accrual Rates for Percent of Earnings and Flat Plans With Ten-Year Cliff Vesting, Early and Normal Retirement at 55–65, and Early or Normal Retirement Supplement, by Type of Supplement

Age	Normal supplement (2 plans)	Early supplement (10 plans)	Both supplements (10 plans)
40	.065	.111	.035
41	.012	.197	.009
42	.013	.023	.011
43	.015	.026	.013
44	.017	.031	.018
45	.019	.035	.023
46	.022	.040	.030
47	.025	.047	.037
48	.028	.053	.044
49	.032	.060	.052
50	.036	.069	.060
51	.040	.079	.070
52	.045	.094	.081
53	.051	.106	.095
54	.057	.121	.108
55	.065	.442	.621
56	.047	−.0007	−.051
57	.051	−.008	−.049
58	.054	−.014	−.043
59	.058	−.022	−.046
60	.061	−.011	−.051
61	.066	−.049	−.068
62	.070	−.058	−.072
63	.074	−.073	−.080
64	.078	−.022	.009
65	.601	−.031	.008
66	−.181	−.247	−.092
67	−.180	−.213	−.167
68	−.179	−.207	−.164
69	−.179	−.204	−.163
70	−.178	−.201	−.160

TABLE 6
Weighted Average Accrual Rates for Percent of Earnings and Flat Plans With Ten-Year Cliff Vesting and Early or Normal Retirement Supplements, by Early and Normal Retirement ages[a]

Early ret.	55	55	55	60	60	62
normal ret.	55	60	65	60	65	62
No. of plans	19	56	22	37	2	19
Age						
40	.199	.136	.082	.078	.068	.056
41	.039	.024	.015	.014	.012	.010
42	.045	.027	.018	.016	.013	.011
43	.052	.030	.021	.018	.015	.013
44	.059	.034	.025	.020	.017	.151
45	.068	.038	.030	.022	.019	.180
46	.077	.043	.036	.023	.022	.020
47	.088	.049	.041	.027	.025	.023
48	.100	.055	.048	.030	.028	.026
49	.114	.062	.056	.035	.032	.030
50	.129	.070	.064	.039	.036	.035
51	.148	.080	.074	.044	.040	.029
52	.167	.090	.087	.050	.046	.033
53	.191	.103	.099	.057	.053	.039
54	.220	.117	.113	.066	.061	.044
55	.389	.498	.484	.075	.069	.060
56	−.019	.071	.016	.086	.080	.064
57	−.078	.071	.019	.099	.092	.161
58	−.048	.071	−.021	.114	.107	.097
59	−.057	.069	−.026	.132	.123	.110
60	−.067	1.079	−.008	.643	.233	.127
61	−.085	−.292	−.049	−.208	.048	.146
62	−.093	−.301	−.056	−.212	.045	.183
63	−.108	−.353	−.067	−.227	.039	−.078
64	−.079	−.079	−.006	−.102	.072	−.086
65	−.086	−.043	.018	−.099	.194	−.094
66	−.124	−.088	−.182	−.100	−.048	−.169
67	−.141	−.116	−.195	−.088	−.064	−.111
68	−.150	−.124	−.191	−.092	−.072	−.112
69	−.151	−.132	−.188	−.097	−.112	−.113
70	−.151	−.141	−.186	−.102	−.120	−.114

[a] There are no plans in the 62–65 or in the 65–65 early–normal retirement groups.

and, therefore, provide very important incentives to remain with the firm until the age that the special supplement is awarded. The special supplements also further dramatize the wide variation in the incentive effects implicit in the provisions of private pension plans.

6. PENSION ACCRUAL AND RETIREMENT IN A LARGE FIRM

This section considers the relationship between pension accrual and retirement in the Fortune 500 firm whose plan is described in section 3. The data are the employment and earnings histories between 1969 and 1984 of all workers employed by the firm in any years between 1980 and 1984. There are five sex-occupation groups: male and female office workers, male and female salesworkers, and male managers. The provisions of the firm pension plan are such that different workers face very different pension accrual profiles and, thus, pension compensation. As a consequence, different workers face very different incentives for continued work versus retirement.

To illustrate these provisions, pension accruals and predicted wages (see Kotlikoff and Wise (1987)) for managers with different birth and hire years are shown in Tables 7 and 8, respectively. Those born in 1940 reach age 55 in 1995, and for each of these groups there is a discontinuous increase in pension wealth in that year. It is $29,639 for those with fifteen years of service in that year and $82,953 for those with twenty-five years of service. Comparable jumps occur in 1985 for those born in 1930. Accruals are often negative for persons over 60. The differences in accruals because of different amounts of service indicated in the table reflect the fact that the benefit formula and early retirement reduction factors are service dependent.

Pension accruals provide a large incentive for some groups to stay in the firm for another year and a strong incentive for others to leave. For example, staying with the firm in 1985 brings pension accrual of $72,527 for 55-year-old managers with twenty-five years of service (born in 1930 and hired in 1960), but a *loss* of $14,936 for 65-year-olds with thirty-five years of experience (born in 1920 and hired in 1950). Thus there is enormous variation across older workers in the effective compensation for continued service. One might expect, therefore, that some groups would be much more likely than others to retire in a given year.

The pension accrual profiles for other employee groups look very much like those for male managers. Accrual is minimal during the first years of service. There is a substantial discontinuous increase in pension wealth at

age 55; and accrual typically becomes negative after thirty years of service—sometimes before that. Social Security accrual becomes negative after 65. The major differences among the groups stem from different age-earnings profiles. An illustration of the similarity and difference is provided by comparing Figure 3, which depicts accrual profiles for male managers, with Figure 7, which depicts profiles for salesmen.

6.1 The Retirement Response to the Pattern of Pension Accrual

Table 9 presents annual departure rates, the proportion of workers who leave the firm before the end of the year, cross-tabulated by age and years of service. Several aspects of the data stand out. There is substantial turnover in the first nine years of employment, especially during the first five years. On average, about 15 percent of those employed five years or less leave in a given year. The table shows rates only for employees 40 and older. The departure rates are somewhat higher for younger workers, 16 or 17 percent for those employed five years or less, and 10 to 12 percent for those employed 6 to 9 years. There is a sharp decline in departure rates at ten years of service, when employees are about to become vested in the pension plan. Before the early retirement age (55), the typical decline is from 8 or 9 percent to 4 or 5 percent. After 55, when vesting carries with it eligibility for early retirement, it is much sharper, often from 10 percent or more to 3 percent or less.

The availability of early retirement benefits at 55 apparently has a substantial effect on retirement. Before 55, departure rates are typically around 2 percent over a broad spectrum of age-service combinations. At 55, they jump to 10 percent or more. Note that the departure rates stay at that level until age 60, when there is another jump in the rate of departure. The jump at 60 corresponds to the age at which pension accrual becomes negative for many employees.

To understand the potential importance of the early retirement benefits, suppose that if it were not for this inducement, the departure rates would remain at 3 percent until age 60, instead of the 10 or 12 percent rates that are observed. (Notice that the departure rates for employees aged 55 to 61 who are in their tenth year of service—not yet vested and hence not eligible for early retirement benefits—are also 2 or 3 percent on average.) Departure at 3 percent per year would mean that 14 percent of those employed at 55 would have left before age 60. At a departure rate of 11 percent per year, 44 percent would leave between 55 and 59. Such a difference, even if only for a small proportion of all firms, can have a substantial effect on aggregate labor force participation rates.

The jump in departure rates at 60, especially noticeable for persons with twenty-five or more years of service, was just mentioned. There is another

TABLE 7

Accrual in Pension Wealth by Year of Birth and Year of Hire for Managers

Year Born	1960	1950		1940			1930
Year Hired	1980	1980	1975	1980	1975	1970	1980
1980	0	0	0	0	0	508	0
1981	0	0	0	0	0	380	0
1982	0	0	0	0	0	770	0
1983	0	0	0	0	0	582	0
1984	0	0	1,278	0	2,470	1,494	0
1985	0	0	251	0	475	767	0
1986	0	0	663	0	1,335	2,090	0
1987	0	0	353	0	651	994	0
1988	0	0	663	0	1,289	1,978	0
1989	1,008	2,158	767	4,037	1,479	2,323	22,194
1990	194	388	890	688	1,709	2,676	831
1991	341	690	1,051	1,297	2,174	3,168	1,060
1992	418	845	1,260	1,601	2,675	3,820	609
1993	504	1,016	1,485	2,021	3,202	4,515	− 89
1994	606	1,220	1,756	2,603	3,851	5,351	− 908
1995	716	1,441	2,043	29,639	40,727	82,953	− 2,067
1996	843	1,695	2,555	7,130	9,538	9,898	5,217
1997	987	1,986	2,992	7,349	9,672	11,334	4,579
1998	1,153	2,422	3,499	7,437	9,641	10,665	3,902
1999	1,342	2,969	4,085	7,377	9,426	7,844	3,186
2000	1,558	3,492	3,900	7,140	6,196	8,643	2,423
2001	1,807	4,095	4,481	4,432	2,198	− 6,178	0
2002	2,093	4,790	5,149	3,750	1,206	− 7,237	0
2003	2,517	5,587	5,904	2,870	− 15	− 8,380	0
2004	3,037	6,502	6,763	1,791	4,378	− 9,658	0
2005	2,918	95,433	117,775	− 2,553	− 8,981	− 11,004	0
2006	3,361	11,955	14,674	− 1,993	− 4,042	− 6,843	0
2007	3,872	13,705	16,840	− 2,784	− 4,988	− 7,994	0
2008	4,461	13,022	15,944	− 3,601	− 5,955	− 9,155	0
2009	5,139	9,809	11,879	− 4,436	− 6,930	− 10,299	0
2010	5,910	10,923	13,211	− 5,265	− 7,875	− 11,375	0
2011	6,792	− 6,583	− 8,668	0	0	0	0
2012	7,801	− 7,785	− 10,184	0	0	0	0
2013	8,940	− 9,069	− 11,809	0	0	0	0
2014	10,223	− 10,418	− 13,531	0	0	0	0
2015	168,439	− 11,848	− 15,345	0	0	0	0
2016	21,859	− 8,684	− 12,662	0	0	0	0
2017	25,137	− 9,994	− 14,317	0	0	0	0
2018	23,904	− 11,319	− 15,995	0	0	0	0
2019	17,968	− 12,627	− 17,524	0	0	0	0
2020	19,964	− 13,849	− 18,933	0	0	0	0
2021	− 12,355	0	0	0	0	0	0
2022	− 14,649	0	0	0	0	0	0
2023	− 17,087	0	0	0	0	0	0
2024	− 19,659	0	0	0	0	0	0
2025	− 22,287	0	0	0	0	0	0
2026	− 21,570	0	0	0	0	0	0
2027	− 24,026	0	0	0	0	0	0
2028	− 26,391	0	0	0	0	0	0
2029	− 28,576	0	0	0	0	0	0
2030	− 30,436	0	0	0	0	0	0

TABLE 7

	1930				1920		
1975	1970	1960	1980	1975	1970	1960	1950
0	835	2,686	0	0	1,178	5,146	7,442
0	562	2,059	0	0	−616	−105	−9,132
0	1,413	3,716	0	0	451	2,175	−5,043
0	1,079	2,710	0	0	−2,739	−2,721	−13,235
2,968	3,053	6,530	0	5,090	658	3,575	−2,995
18,226	26,481	72,527	0	−5,357	−5,328	−8,152	−14,936
5,616	8,227	13,781	0	0	8,151	3,728	831
2,593	3,691	4,118	0	0	2,108	−4,957	−10,017
4,105	5,874	8,553	0	4,176	3,987	−1,882	−6,347
3,745	5,342	5,263	0	5,038	2,968	−3,049	−7,920
3,280	4,726	5,382	0	4,265	2,109	−3,889	−8,984
1,685	2,376	−7,118	0	0	0	0	0
1,389	2,029	−7,356	0	0	0	0	0
683	1,312	−8,127	0	0	0	0	0
−155	419	−8,902	0	0	0	0	0
−1,384	−3,515	−10,152	0	0	0	0	0
3,628	−939	−5,346	0	0	0	0	0
2,855	−1,652	−6,363	0	0	0	0	0
2,041	−2,384	−7,386	0	0	0	0	0
1,187	−3,129	−8,394	0	0	0	0	0
−1,882	−3,874	−9,344	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

TABLE 8
Wage Earnings by Year of Birth and Year of Hire for Managers

Year Born	1960	1950		1940			1930
Year Hired	1980	1980	1975	1980	1975	1970	1980
1980	20,405	24,053	33,021	27,894	34,020	40,712	31,825
1981	22,852	26,082	34,967	29,403	35,354	41,853	32,739
1982	25,312	28,057	36,807	30,819	36,586	42,898	33,548
1983	27,757	29,965	38,542	32,141	37,720	43,858	34,256
1984	30,615	32,271	40,774	33,869	39,342	45,410	35,390
1985	33,479	34,543	42,948	35,535	40,904	46,913	36,447
1986	36,331	36,774	45,069	37,140	42,409	48,374	37,427
1987	39,155	38,960	47,139	38,685	43,859	49,794	38,331
1988	41,933	41,092	49,158	40,163	45,250	51,168	39,152
1989	44,653	43,166	51,128	41,572	46,580	52,493	39,886
1990	47,309	45,183	53,056	42,913	47,850	53,766	40,530
1991	49,904	47,147	54,951	44,187	49,059	54,987	41,083
1992	52,429	49,052	56,809	45,387	50,198	56,140	41,533
1993	54,889	50,900	58,636	46,509	51,262	57,216	41,873
1994	57,292	52,698	60,438	47,553	52,247	58,206	42,099
1995	59,645	54,444	62,216	48,514	53,142	59,093	42,200
1996	61,954	56,140	63,969	49,382	53,935	59,860	42,166
1997	64,230	57,786	65,695	50,151	54,615	60,487	41,988
1998	66,481	59,380	67,389	50,812	55,166	60,954	41,656
1999	68,717	60,920	69,047	51,353	55,573	61,236	41,161
2000	70,946	62,398	70,655	51,760	55,816	61,307	40,493
2001	73,178	63,814	72,206	52,023	55,879	61,148	0
2002	75,415	65,151	73,676	52,123	55,739	60,728	0
2003	77,667	66,402	75,052	52,047	55,381	60,028	0
2004	79,931	67,550	76,307	51,779	54,783	59,027	0
2005	82,213	68,581	77,417	51,305	53,931	57,709	0
2006	84,502	69,471	78,349	50,609	52,810	56,063	0
2007	86,796	70,199	79,069	49,678	51,410	54,084	0
2008	89,081	70,739	79,543	48,503	49,727	51,778	0
2009	91,347	71,067	79,735	47,081	47,764	49,160	0
2010	93,567	71,151	79,604	45,408	45,526	46,251	0
2011	95,721	70,965	79,114	0	0	0	0
2012	97,774	70,478	78,230	0	0	0	0
2013	99,694	69,665	76,922	0	0	0	0
2014	101,438	68,503	75,168	0	0	0	0
2015	102,959	66,974	72,952	0	0	0	0
2016	104,202	65,062	70,267	0	0	0	0
2017	105,115	62,766	67,124	0	0	0	0
2018	105,638	60,090	63,546	0	0	0	0
2019	105,712	57,051	59,572	0	0	0	0
2020	105,277	53,675	55,254	0	0	0	0
2021	104,279	0	0	0	0	0	0
2022	102,671	0	0	0	0	0	0
2023	100,415	0	0	0	0	0	0
2024	97,484	0	0	0	0	0	0
2025	93,875	0	0	0	0	0	0
2026	89,598	0	0	0	0	0	0
2027	84,690	0	0	0	0	0	0
2028	79,209	0	0	0	0	0	0
2029	73,239	0	0	0	0	0	0
2030	66,886	0	0	0	0	0	0

TABLE 8

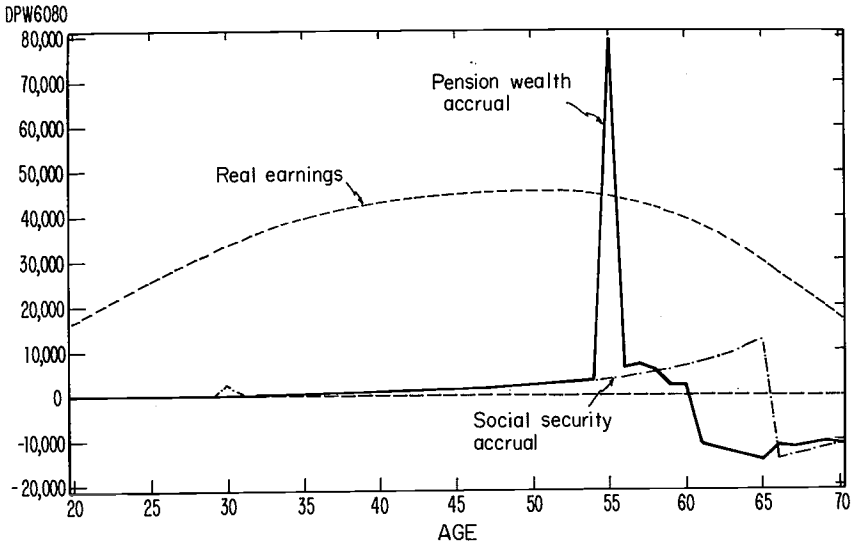|	1930				1920			
1975	1970	1960	1980	1975	1970	1960	1950	
34,945	38,666	48,446	35,723	35,788	36,519	40,186	47,598	
35,666	39,226	48,813	36,006	35,902	36,470	39,794	46,774	
36,289	39,693	49,098	36,188	35,919	36,323	39,280	45,765	
36,819	40,074	49,300	36,276	35,845	36,080	38,642	44,568	
37,818	40,977	50,156	36,819	36,215	36,277	38,446	43,828	
38,741	41,803	50,919	37,271	36,488	36,362	38,092	42,847	
39,588	42,551	51,579	37,632	36,660	36,333	37,574	41,624	
40,358	43,216	52,122	37,900	36,728	36,181	36,885	40,157	
41,042	43,785	52,524	38,066	36,679	35,895	36,014	38,445	
41,633	44,249	52,765	38,124	36,507	35,467	34,956	36,499	
42,127	44,599	52,826	38,067	36,205	34,891	33,713	34,339	
42,517	44,827	52,690	0	0	0	0	0	
42,790	44,914	52,329	0	0	0	0	0	
42,935	44,847	51,724	0	0	0	0	0	
42,946	44,616	50,861	0	0	0	0	0	
42,809	44,207	49,725	0	0	0	0	0	
42,513	43,607	48,307	0	0	0	0	0	
42,048	42,805	46,602	0	0	0	0	0	
41,403	41,794	44,615	0	0	0	0	0	
40,570	40,568	42,359	0	0	0	0	0	
39,542	39,125	39,852	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
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0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	

FIGURE 7. *Pension wealth accrual, SS accrual and wage earnings for salesmen born in 1960 and hired in 1980, in real 1985 dollars.*

sharp increase in departure rates at 62 when Social Security benefits are first available. The increase at 62 is also noticeable for employees with less than ten years of service and not yet vested in the firm's pension plan. They can take Social Security benefits, of course.

Finally, there is a very sharp increase in the departure rate at age 65. For many workers the total reward for working after age 65 is close to zero, due to negative pension and Social Security accruals. It is important to keep in mind that the large departure rates before 65 mean that most employees have left well before that age. Thus high annual departure rates at 65 indicate only that a large proportion of the few that continue working until 65 retire then. This point is highlighted in Table 10, which presents the cumulative fraction remaining with the firm from age 50 to each specified age.

Note first that departure rates of employees who have been in the firm for only eight to ten years and are not yet vested are very low at every age, as emphasized above. And again, the increase in the departure rates at 55, 60, 62, and 65 stands out. Based on the 1981 and 1983 departure rates, only 48 percent of those employed at 50 would still be employed at 60, and then 17 percent of these would leave. Only 10 percent would remain until age 65 and then about 50 percent of these would leave.

TABLE 9
Departure Rates, by Age and Years of Service, of All Employee Groups (percent)

						Years of service								
Age	≤5	6–9	10	11–15	16–20	21–23	24	25	26	27	28	29	30	31+
40	15	8	5	7	4	3	0							
41	14	9	5	7	5	5	3	5						
42	14	10	8	8	4	2	2	2	0	0				
43	15	7	6	5	4	4	4	3	2	0	0	0		
44	13	8	5	7	3	2	3	1	1	1	0	0	0	
45	11	7	5	6	6	4	3	1	4	2	3	5	0	.5
46	12	9	3	5	3	4	4	1	0	5	2	2	0	0
47	14	8	8	5	4	3	3	4	4	4	0	4	2	0
48	12	7	5	6	4	4	2	5	1	2	4	2	3	2
49	14	9	4	7	4	3	5	1	1	1	1	2	0	0
50	14	8	4	6	4	3	3	2	2	1	1	3	2	3
51	14	9	3	5	3	3	5	2	3	4	2	2	2	5
52	11	7	5	6	4	4	2	4	2	4	1	3	6	6
53	12	7	4	7	4	3	3	3	3	2	3	3	3	3
54	11	7	4	6	4	2	4	2	2	3	1	0	1	3
55	9	5	4	11	9	11	13	10	13	11	12	7	9	9
56	11	6	6	12	11	12	7	8	11	11	12	16	14	12
57	12	10	1	11	8	9	10	8	9	9	3	14	11	11
58	13	10	2	8	8	12	13	11	13	15	9	10	13	12
59	7	10	2	17	8	11	17	14	13	14	9	10	12	15
60	9	9	3	15	12	19	16	17	20	16	20	15	19	26
61	9	7	2	16	17	15	19	12	25	16	23	21	24	30
62	11	15	7	27	34	37	34	33	38	40	42	34	30	41
63	14	18	4	33	35	37	43	35	43	41	62	33	47	40
64	5	8	3	36	33	34	18	32	26	27	42	53	41	34
65	12	35	45	57	52	54	44	55	57	70	50	54	69	59
66	26	17	25	16	16	43	50	16	20	25	38	33	9	24
67	13	28	18	32	17	29	0	14	21	0	13	33	50	21
68	13	50	50	15	25	11	0	50	0	29	0	0	0	12

The data also show the effect of a special early retirement incentive that was in effect in 1982 only. The incentive program provided a bonus to employees who were eligible for early retirement in 1982; that is, those who were vested and were 55 years old or older. The bonus was equivalent to three months salary for 55-year-old employees and increased to twelve

<div style="text-align: center">

TABLE 10

Cumulative and Yearly Departure Rates by Calendar Year, Years of Services, and Age

</div>

Age	YDR[a] (8–10 YOS[b]) 1980	YDR (11+ YOS) 1981	1982	1983	Cumulative Fraction Staying in Firm (11+ YOS) 1981	1982	1983
50	7				97	97	97
51	9	3			94	94	94
52	3	5	5	.	89	89	89
53	0	4	4		85	86	86
54	4	3	4	2	83	83	84
55	5	11	12	10	74	73	75
56	4	12	14	10	66	63	68
57	2	9	12	11	60	56	61
58	5	10	14	12	54	48	54
59	2	11	20	10	48	38	48
60	4	17	29	17	40	27	40
61	0	17	32	18	33	18	33
62	8	36	48	31	21	10	23
63	14	37	54	37	13	5	14
64		29	49	26	10	2	11
65			58	45	5	1	6
66							

[a] YDR = yearly departure rates.

[b] YOS = years of service.

months salary for 60-year-olds. At age 65, the bonus was twelve months salary for employees with twenty or fewer years of service and declined to six months salary for those with thirty to thirty-nine years of service.

It is clear that the effect of the incentive was large. The departure rates for 1981 and for 1983 are virtually identical. But the rates were much higher in 1982. For example, the departure rate for 60-year-olds was 17 percent in 1981 and in 1983, but 32 percent in 1982. For those aged 63, the departure rate was 37 percent in 1981 and in 1983, but 54 percent in 1982. Of those employed at age 50, 40 percent would still have been employed after age 60 based on the 1981 and 1983 departure rates. Only 27 percent would remain after age 60 based on the 1982 rates.

A great deal of effort has been devoted to estimating the effect of Social Security provisions on labor force participation. In particular, Hausman and Wise (1985), Burtless (1986), and Boskin and Hurd (1984) have

attempted to estimate the effect on labor force participation of the increases in Social Security benefits during the early 1970s. It would appear from the results here that the effects of these across-the-board increases in Social Security benefits are likely to be small relative to the effects of the private pension provisions. For example, it seems clear that shifting the age of early retirement in the firm plan from 55 to 60 would have a very dramatic effect on departure rates. Leaving the early retirement age at 55, but eliminating negative pension and Social Security accruals, thereafter, would apparently also have a substantial effect on retirement rates.

7. SUMMARY AND CONCLUSIONS

Most defined benefit plans are strongly backloaded, notwithstanding ERISA legislation aimed at limiting it. For a sizable fraction of defined benefit plans, the special shape of pension accrual profiles produced significant incentives to remain with one's current employer before early retirement. After the age of normal retirement, and often after early retirement, pension accrual profiles typically provide substantial incentives to leave employment. They impose a large implicit tax on employment. These retirement incentives appear large when compared, for example, with the retirement incentives arising under Social Security. Hence, the structure of private pensions may be contributing substantially to the very high rates of early retirement currently observed in the United States.

Under the contract view of labor markets, pension accrual profiles might be thought of as carrot-stick incentives to continue working diligently to some age and to retire at a subsequent age. This presumes that pension accrual profiles are well understood by both employers and workers. In our view this is unlikely. The great complexity of pension provisions makes it quite difficult for either employers or workers, in the absence of assistance from actuaries, to calculate correctly their accrued pension benefits. A few firms, including the large Firm examined here, provide accrual information annually to their workers, but most, apparently, do not. It also appears that many firms with access to actuaries do not have their actuaries calculate worker-specific accrual.

It is important to understand the effects of pension plan provisions on the labor force participation of older workers. But the contract view of the labor market also makes it clear that evaluation of pension accrual is best considered in conjunction with age-wage compensation profiles. If, for example, legislation were to prevent the reduction in the compensation of older workers through pension plan provisions, such reduction might be sought through reduction of wage and salary earnings, to conform to age-productivity profiles. In this case, what constitutes age discrimination

and the potential effects of age discrimination legislation must also be considered. A partial view of the whole may yield decisions with unforeseen and unintended consequences. Pension plan provisions may provide a graceful way of making adjustments in a firm's labor force, and, in particular, of releasing older workers from the labor force. On the other hand, the decision to continue work at older ages is not, now, a neutral one. In the words of tax analysts, the playing field is far from flat. Should individual preferences for work versus retirement be constrained by the implicit wage-tax structure of pension plans?

The backloading of pension accrual in the presence of limited worker and employer understanding of such backloading raises a variety of important questions. Do workers over- or undervalue their accrued vested pension benefits? Do workers over- or undersave because they under- or overvalue their pensions? Are workers who leave highly backloaded firms prior to the age of early retirement, at which age accrual is often very substantial, aware of the often substantial pension costs of their actions? Is accrual backloading raising the economic costs of early disability, because workers who become disabled prior to the age of early retirement receive less generous pensions than those who remain through early retirement? Should employers be required to provide workers with annual statements detailing accrued vested benefits as well as the time path of future projected pension accrual? These and related questions may need to be asked by employers, workers, and the United States Congress.

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