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AN ANALYSIS OF PENSION BENEFIT FORMULAS, PENSION WEALTH AND INCENTIVES FROM PENSIONS

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ABSTRACT

This paper investigates empirical issues related to pensions. It uses the 1983 Survey of Consumer Finances (SCF), a data set with detailed information both on workers and on their pensions. The paper presents new estimates of pension values for various groups. It compares pension values based on relatively complete SCF data with estimates based on incomplete data of the type found in other data sets. It also examines incentives that pensions create for retirement and job mobility, and relates these incentives to plan characteristics. Some findings appear inconsistent with standard explanations for the existence and nature of pensions.

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I. Introduction.

This paper is a study of pensions. Pensions are complex and multifaceted contractual arrangements which serve a variety of purposes. They are partly a means for tax-deferred saving, partly a way to solve adverse selection problems in the provision of old age annuities, partly a method of providing complex incentives regarding job mobility and retirement, and perhaps even partly a vehicle for intergenerational transfers.

Until recently, studies of this important fringe benefit have been hampered by a lack of high quality data linking the pensions themselves and the people who are covered by them. This problem has been substantially alleviated by the availability of the 1983 Survey of Consumer Finances (SCF), a nationally representative survey of households. The household survey solicits basic information about wages, employment history, and demographic characteristics. It also asks respondents about pension coverage, and if covered, it asks them to describe certain aspects of their pensions and to indicate the employer who is providing the pension. In turn, requests are made from the employer for very detailed information about eligibility for benefits and the manner in which benefits are calculated. By linking the information provided by the workers with that provided by the firms, these data provide a unique opportunity to measure and analyze pension plans.

This paper takes advantage of that opportunity to examine pensions in a variety of different lights. The first of these is simply to ascertain the value of pensions to workers who are covered by them. After a brief description of the relation of pension formulas to pension wealth in Section II, the paper turns in Sections III and IV to a detailed analysis of pension wealth by various measures. Section III considers the value of the pension if the worker stays until retirement. We find that a worker with a typical defined benefit or combination plan will enjoy $135,000 in pension benefits

(in 1983 dollars) if the worker stays with the firm until qualifying for normal retirement benefits. This amounts to over 14.3% of the present value of the worker's earnings over the life of the job. In Section IV, the paper addresses the issue of the current (as of 1983) value of pensions. Unfortunately, there is no consensus as to how to allocate the ultimate amount of the pension between the value already earned and the value attributable to work in future years. As a result, estimates of current pension assets for a worker with a typical defined benefit or combination plan range from $20,000 to $47,000, depending on the method used.

The second broad issue to be examined is the degree to which estimates of pension wealth are degraded by the use of incomplete or specialized data, as is required when most existing data sets are used. For example, most longitudinal and cross-section data sets based on household or individual responses contain at best only sketchy information on pensions, and heroic assumptions are required to translate this information into pension values. At the other extreme, surveys such as the Banker's Trust Survey and The Level of Benefits Survey contain detailed information on the pensions but give no information on the wage levels or dates of hire for the individuals covered by them. For both cases, the SCF provides an opportunity to see how well pension values calculated from the incomplete information available in other surveys compare with analogous values calculated from the more complete information in the SCF. These comparisons are taken up in Section V of the paper.

A third broad issue, addressed in Section VI, is the nature of the incentives provided by pensions. In considering whether or not to retire, for instance, an individual considers not only the wage but also the increase in the value of the pension if he works one more year. This value typically rises at an increasing rate up to the age when the individual is eligible for retirement benefits. Further, there are frequently substantial discrete jumps in pension value at the early and/or normal retirement ages. The timing and magnitude of these incentives varies considerably among

plans, and within any particular plan, among those workers hired at different ages. These incentives appear to be partially related to a number of plan characteristics, among which the most important are the requirements for normal retirement. Similar points arise if instead of retirement, the question is whether or not to move to another job. For this question, however, the relevant amount is the increase in pay in the new job needed to make up for the pension in the current job.

The last empirical issue, taken up in Section VII, is the relation of pensions to union status, gender and race. With regard to unions, our results support Freeman's (1985) claim that although unions raise pension coverage, they do not affect pension values except indirectly as a consequence of the union wage effect. Females and blacks have both lower pension coverage and, conditional on coverage, lower pension values than do males and nonblacks. However, after standardizing for other individual and firm characteristics, blacks covered by pensions do not appear to have a lower ratio of pension wealth to earnings wealth than do nonblacks, and females appear to have if anything higher ratios than do males.

The final section of the paper considers the implications of these empirical findings for various theories regarding the existence and nature of pensions. It notes that several of these findings are difficult to interpret in light of some of the more popular explanations for pensions. Nevertheless, it is important that we reach a better understanding than we presently have of the behavioral processes which generate pensions. There are currently several proposals to modify or regulate pensions or to require firms not currently offering pensions to do so, and a valid behavioral model of pensions is necessary in order to predict the ultimate effects of these proposals. It is to provide a more solid empirical basis for evaluating such models that this paper is directed.

II. Relation of Pension Formulas to Measures of Pension Wealth: The Analytical Framework.

This section discusses the relation of pension formulas to the various measures of pension wealth and pension accrual that will be calculated from the SCF data. A number of the basic relations discussed here have been analyzed by Barnow and Ehrenberg (1979), Bulow (1981, 1982) and Kotlikoff and Wise (1985, 1987).

For purposes of analyzing the pension wealth measures, we use a simple final average salary, defined benefit plan[1]. Benefits are calculated from the formula aW_fS, where a is the generosity parameter of the plan, W_f is the final wage, and S is the number of years of service at retirement.[2] Wages are assumed to grow from W_0 in period 0 at a rate of g, and years of service are measured as the difference between the date of separation k and the date of hire j. Assume for simplicity that there is certain life expectancy to date D and that benefits are vested from the first day of employment[3]. Let R denote the date of normal retirement. R may be determined in the plan as the date when the individual reaches a particular age, or it may be the date when years of service or some combination of age and service reaches a specified level. Early retirement benefits may be available, but in this example they are assumed to be actuarially fair.

Under these assumptions, the present value of pension benefits to which the individual is entitled as of year k is given by:

$$(1) \qquad P(k) = \int_R^D a\, W_0 e^{kg}\, (k-j)\, e^{-r(t-k)}\, dt$$

$$= a\, W_0 e^{kg}\, (k-j)\, e^{-r(R-k)}\, [1-e^{-r(D-R)}]/r$$

for $k < R$. The last term in the expression discounts the benefits back to year k. For $k > R$, benefits commence upon retirement, and the lower limit of the integral in the above expression becomes k instead of R.

As long as the benefit formula is otherwise the same, the present value of the pension as of year k is

$$(2) \qquad P(k) = a\, W_0 e^{kg}\, (k-j)\, [1-e^{-r(D-k)}]/r$$

which is similar to the previous formula except that k has replaced R wherever R appeared in equation (1).

Crediting work beyond the normal retirement age is required under current regulations. However, it was not required in 1983, which was the year of the SCF survey. At that time, many firms did not give credit for work beyond the normal retirement age. Further, they froze the final wage used in the formula at the level as of the normal retirement date R. Provisions such as these cause the profile of pension values to decline sharply at the age of normal retirement and the increment in pension value from continued work to be negative.

Following Bulow (1982) and differentiating equation (1) with respect to k indicates the path of the marginal increment to pension wealth with additional service:[4]

$$(3) \qquad dP(k)/dk = P(k)\, [g + r + 1/(k-j)]$$

for any time k preceding the year of eligibility for normal retirement. During this time, the second derivative of the pension value with respect to k is positive. Therefore, the relation between the present value of the pension and time of separation will be convex to the time axis, indicating that pension benefits are backloaded under a simple defined benefit plan. Because the value of the pension rises with the sum of the growth rate in earnings, the discount rate, and the proportionate increase in experience, the ratio of the present value of the pension to the wage will be increasing with tenure on the job. (For a comparable derivation for the ratio of

pension accrual to the wage, see Kotlikoff and Wise, 1985, 1987.)

For the case where the individual works past normal retirement age, and credit is given for such work, the pension accrual rate is given by

$$(4) \qquad dP(k)/dk = P(k)\ \{g + r + 1/(k-j) - r/[1-e^{-r(D-k)}]\}$$

In this expression, the last term in the brackets reflects the fact that in this case, benefits are foregone when retirement is postponed. If this loss is sufficiently large, the value of the pension may begin to decline as soon as the normal retirement age is reached. In any case, the relative importance of this loss increases with k. This implies that eventually the value of the pension must begin to decline, and once it starts to decline it will do so at an accelerating rate.

At the points where the individual qualifies for normal retirement benefits, there is a sharp discontinuity in the accrual profile where equations (3) and (4) are joined. If early retirement is available with actuarially favorable reductions, there will be another discontinuity at the age of eligibility for early retirement. Further, as will be seen below, many defined benefit pension plans base benefits on two or three formulas. One formula may pertain to benefits for those who leave the firm before qualifying for early retirement (i.e., for terminated-vested employees), and another to those who qualify for normal retirement, with various treatments for work past normal retirement date. There may also be another formula, or perhaps only a simple adjustment factor applied to the formula for normal retirement benefits, to determine benefits for those who qualify for early retirement. At the dates when the individual switches from one formula to another, there may be a discrete jump in pension value, creating a sharp spike in the accrual profile. Such spikes are examined empirically below.

For a defined contribution plan, the value of the pension as of year k is

$$(5) \qquad P_{dc}(k) = \int_{j}^{k} c\, W_0 e^{gt}\, e^{r(k-t)}\, dt$$

for an individual still employed at that time, where c is the contribution rate. For $g = r$, the value is the sum of the real value of contributions. The slope of the profile represented by equation (5) is positive, and the second derivative depends on whether the rate of growth of wages exceeds or falls below the interest rate.

III. Formula Based Measures of Expected Pension Wealth For Currently Covered Workers.

Estimates of pension wealth from working until the indicated time of separation are presented in the first row of Table 1 for private-sector employees who are covered by defined benefit or combination plans.[5] These pension values are obtained by applying the pension formulas reported by firms in the SCF, using the wage and tenure of the workers wherever appropriate in the formulas. Wages are projected forward and backward in time by applying the tenure and experience parameters of an estimated wage equation to the actual wage reported by each individual. In other words, the height of the wage profile specified in the estimated equation is adjusted so that the profile goes through each worker's observed wage point. Economy wide wage growth is set equal to the average rate in the previous thirty years, which is assumed equal to the interest rate. The computations, including adjustments for inflation, are described in more detail the Appendix.

Each column of Table 1 represents a different assumption about the time of separation from the firm. Column 1 assumes separation at age 55. Thus the average present value of the pension (pension wealth) <u>from the current job</u> would be $87,000 in 1983 dollars if the individual were to separate from

that job at age 55. If, as in column 3, separation were at age 65, the average present value of the pension would be $134,000. Columns 6 and 7 apply if the worker remains with the firm until qualifying for early or normal retirement benefits under the plan. In the sample of workers covered by defined benefit or combination plans, the average age of eligibility for early retirement benefits is 55, and the average age for normal retirement benefits is 61.4.

The distribution of pension wealth is truncated on the left at zero and has a long tail on the right hand side. Consequently, the mean is considerably above the median, which is reported in row 4. The median may be the preferred statistic to use, since it is not as subject to the influence of outliers as the mean. Row 2 reports the standard deviation of pension values, and rows 3 and 5 report the first and third quartiles. For comparison, row 6 reports the wealth equivalent of net wage earnings from date of employment at the firm to the indicated date of separation.

Average values of the ratio of expected pension wealth to expected earnings wealth are reported in row 7, followed by the standard deviations in row 8. If the current group of covered workers remain with their firms until the age of normal retirement specified in their plan, expected pension wealth would, on average, amount to 14.3% of wealth equivalent of expected earnings. If they remain only until age 55, pension wealth would still amount to 10.9% of wealth from earnings. The comparable figures for the median ratio of pension wealth to earnings wealth are 13.8% and 9.9%.

The relevant statistics for defined contribution plans are reported in the lower part of the table. It is apparent that pension wealth is considerably lower for those covered by defined contribution plans, amounting to between 7 and 7.5 percent of earnings wealth for those working to ages 55 and 65 respectively. For those retiring in this age range, the average pension wealth of those covered by a defined contribution plan amounts to 50% to 55% of the pension wealth held by those covered by defined benefit plans. In contrast, the average wealth from earnings of those

covered by defined contribution plans is 83 to 87% of the comparable figure for those covered by defined benefit plans.

Relation Between Pension Wealth From Work Until Retirement And The Wealth Equivalent Of Earnings.

Behavioral models on both the supply and demand sides of the market suggest that wages and pensions are jointly determined. Therefore any effort to relate one to another can best be viewed as a descriptive exercise. One such an exercise is the regression of log pension wealth on log earnings wealth for those in the sample who are covered by defined benefit or combination plans. The regression of pension wealth P (computed at age of normal retirement) on earnings wealth E is

$$\ln P = -2.17 + 1.006 \ln E \qquad R^2 = 0.513,$$
$$(3.76)\ (23.59) \qquad N = 530$$

where absolute t-statistics are in parentheses. The elasticity of pension wealth with respect to wealth from earnings at the point of means is estimated to be virtually equal to unity. When pension and earnings wealth are computed at the age of early retirement, the elasticity rises to 1.10. These findings suggest that, conditional on plan type, wealth from wages will, on average, result in a proportionate understatement of total compensation for individuals at various earnings levels.

The R^2 on the pension wealth-earnings wealth regression indicates that almost half of the variation in ln pension wealth is not correlated with the wage. Lines 9 through 11 of Table 1 provide an indication of the scope of the problem. For example, assuming retirees leave the work force at the age of normal retirement specified in the plan, pension wealth varies from 9.0% of wealth from earnings at the first quartile to 18.1% of wealth from earnings at the third quartile.

Pension Wealth Adjusted For Turnover.

In Table 2, the first row indicates the expected value of pension wealth computed on assumptions of turnover rates of 0, 2 and 4 percent per year until the normal retirement date. For workers in the sample who are covered by a pension, the five year separation rate computed from the self- reported employment histories is about 7.9%, or about 1.5% per year. In the first column, the figure of $134,000 for pension wealth at zero turnover is computed for retirement at the current age (in 1983) or the age of normal retirement as specified in the plan, whichever is later. It differs slightly from the corresponding figure in Table 1, which is always calculated on the assumption of retirement at the normal retirement age. The figures reported in the second and third columns suggest that a 2% turnover rate would reduce expected pension wealth by 20% and a 4% turnover rate would reduce it by 34%.

Expected Pension Wealth From Work To Normal Retirement Compared To Social Security Wealth.

The value of social security wealth among individuals in the sample who are covered by a defined benefit or combination pension is about $100,000. This figure reflects the individual's own earnings only, excludes any spouse benefit, and assumes work to the normal retirement age on some job offering the same wage path as the job held in 1983. The social security calculations use an average monthly wage over the period from the beginning of the current job until retirement, with wages indexed to age 60 but not thereafter. Benefit amounts are calculated from the formula currently in place. Notice in Table 2 that with no turnover, pension wealth from the current job would substantially exceed social security wealth from a lifetime of work, at least for individuals with defined benefit or combination plans. At an annual turnover rate of 4%, however, the expected pension wealth from the current job falls below social security wealth.

IV. Issues In Allocating Pension Wealth To Each Year Of Work.

There has been controversy about whether pension values (liabilities) should be measured on the assumption that work continues into the future (the implicit contract view) or on the assumption that the current period of employment is the last (the legal view). Among the protagonists in this controversy are Bulow (1982), Ippolito (1985), and Kotlikoff and Wise (1985). This controversy is also relevant to current accounting practice, which, under Financial Accounting Standards Board Statement 87, incorporates elements of each approach.

When the individual or firm is engaged in a short term employment decision which requires the calculation of the value of one more period of work, the legal method is a natural approach to use. However, when the period of attachment is long term and a number of years of attachment remain, the question is how to allocate the pension paid at the end of the employment period to each year of work within the period of attachment. There is no unique answer to this question. Conceptually, the problem is similar to the issue of how to depreciate the value of a long term asset over its years of usefulness. There is no single correct answer to this allocation decision, and any decision will be to some extent arbitrary.

Despite the basic conceptual problem, a number of different approaches have been taken to obtain an accrual profile. The first approach is the legal view of Bulow (1982). The firms' liabilities to covered workers are calculated as though each period of employment is the last, which is analogous to calculating the depreciation of an asset strictly on the basis of the asset's resale value. Under current law, this is the way that, in the event of plan termination, pension liabilities are calculated. Thus, in accordance with equation (3), it is possible to integrate along the path from date of hire to obtain the value of the firm's liability to the worker.

A second approach is to amortize the benefits accrued by the end of the employment period, allocating principal and interest to each year of employment on the basis of some explicit depreciation scheme. There are

elements of this approach in both Freeman (1985) and Lazear and Moore (1985).[6] Because economic considerations do not lead to a compelling case for any particular amortization scheme, however, there is no unique method for calculating the profile on this basis.

A third approach, developed by Ippolito (1985), computes pension accrual under an implicit contract from an equation for the pension benefit. At any point in the contract, a pension value is calculated on the basis of "projected" benefits. These projected benefits are computed from the benefit formula using current years of service but the final salary at the end of the implicit contract. A pension wealth figure is then calculated as the discounted value of the projected benefits. This approach is roughly analogous to depreciating the value of an asset expected to last a given number of hours according to the number of hours used each year.

All of these approaches produce the same figure for the present value of the pension paid from date of hire to date of retirement. Each of the measures has some appealing property. Nevertheless, for a contract of known duration, the exact path of pension accrual does not appear to be identified without the imposition of further restrictions.[7]

Current Pension Wealth: Legal Vs. Prorated Values.

Column 5 of Table 1 presents current pension wealth figures according to the legal method. The average pension wealth calculated for current employees according to the legal view suggests that their pension wealth from work to date is $20,000. This is less than one year's average earnings, which for this sample is $25,542 in 1983. It is also only 14.8% of the discounted pension wealth that the individual can expect if he works until normal retirement. For comparison, the average individual in the sample has already received 35.1% of the total discounted earnings that he will receive if he works on the job until normal retirement.

The second row of Table 2 represents the results of prorating pensions between past and future work. More specifically, the figures are calculated

by prorating the final pension wealth values in proportion to the worker's wage earnings each year. For a zero turnover rate, this procedure amounts simply to multiplying the pension wealth at retirement by the ratio of earnings to date to expected earnings in the job. This yields an average amount of $47,000, which is 135% greater than the $20,000 figure for pension wealth calculated by the legal method. At positive turnover rates, less weight is given to the large pension values at retirement and more weight to the relatively lower pension values should separation occur prior to retirement. With a turnover rate of 4 percent, the pension value is $39,000, which is 17% lower than with no turnover and only 95% greater than the wealth calculated by the legal method. Higher turnover rates in general reduce the pension wealth calculated by the prorating method. In the extreme, a 100% turnover rate would yield a value exactly equal to that obtained by the legal method, since the legal method calculates pension wealth as though separation occurs immediately.

Pension Wealth by Current Age and Tenure.

Table 3 reports ratios of pension wealth to earnings wealth disaggregated by the age and tenure of the covered worker in 1983. For the top figure in each pair, both the pension wealth and the earnings wealth are calculated assuming 1983 is the last year of employment, as reflects the legal view. In these figures, a portion of the increase with age and tenure in the value of pension wealth reflects the backloading of defined benefit plans discussed in Section II. The bottom number in each pair is the ratio of pension wealth to earnings wealth assuming work to normal retirement. Looking across the bottom row and down the last column, the numbers in each pair of ratios come closer to one another. This is as expected and reflects the backloading of many pensions.

V. Issues In Measuring Pension Wealth From Incomplete Information.

Most studies do not have available all of the information required for

estimating pension wealth for the currently employed. The Survey of Consumer Finances does provide relatively complete information, and this permits us to compare pension values as calculated with this information to the values which would be calculated for the same individuals and plans but with incomplete or specialized data. Researchers using incomplete or specialized data must typically make strong assumptions in order to obtain estimates of pension values, and it is important in assessing the value of their results to determine the degree to which estimated pension values may be degraded by the particular assumptions which have typically been made.

The Effect Of Using Hypothetical Wages With Observations On Actual Pension Plans.

The Survey of Consumer Finances provides information on pension formulas together with matching information on the wage of covered workers. For most studies which use pension formulas, no accompanying wage data is available for the workers actually covered by the plans. Hypothetical wage data or industry and occupational averages are used instead. It is useful to determine the extent of distortions, if any, from the use of hypothetical data, and to ascertain the procedures which would least distort pension wealth estimates when wage information on covered workers is missing.

Three representative examples illustrate procedures typically followed in earlier studies which had information on plan characteristics, but not on wages or demographic information. Hatch (1982) and her co-workers used pension formulas from the Level of Benefits study. They calculated the value of pensions for a group of hypothetical individuals who retired with final earnings of either $10,000 or $20,000. Lazear (1982, 1983) used data on pension plan formulas from the Bankers Trust surveys. He simulated profiles for a set of hypothetical employees with salaries at retirement of either $9,000, $15,000, $25,000 or $50,000. Most recently, Kotlikoff and Wise (1985, 1987), using the pension formulas in the Level of Benefits Survey, simulated accrual profiles for hypothetical individuals with wages

equal to the average wage in the industry as obtained from a separate data set.

The second through sixth columns of Table 4 indicate the ratios of pension wealth to earnings wealth which result when various assumed wages are used. For reference purposes, the first column indicates the corresponding ratio when the actual 1983 wages for each individual are used. These findings suggest that the ratio of pension wealth to earnings wealth is not seriously distorted when pension calculations are based on mean wages, even when all wages in the sample are constrained to a single value. However, when the hypothetical wage used is far from the mean there is distortion, probably as a result of the minimum and maximum values in the pension formulas, social security offsets and dollar amounts specified in pattern plans. Thus as can be seen, the ratio of pension wealth to earnings wealth is understated when too high a wage is used, and it is substantially overstated when too low a wage is used.

Although the use of average wages rather than actual wages does not affect the mean or median of the ratio of pension wealth to earnings wealth, there remains the possibility that the ratio using actual wages is not well correlated with the ratio using average wages. To investigate this possibility further, we examine a number of correlations, one for each possible year of retirement between ages 55 and 70. These correlations are between the ratio using actual wages and the ratio using the geometric mean wage in the same two-digit industry. Depending on the assumed age of retirement, the correlations ranged from 0.884 to 0.931, with the highest at a retirement age of 55 and the lowest at a retirement age of 65. Alternatively, if the age is specified as the normal retirement in each plan, the correlation is 0.909.

A similar exercise relates the values of the ratios of the increment in pension wealth from an additional year of work to the wage in that year. Here the correlations range from 0.888 at age 62 to 0.991 at age 58. For both exercises, similar results are obtained when the hypothetical wage used

was the geometric mean for the sample as a whole. In general, then, we conclude that the use of average wages with actual pension plan characteristics does not seriously distort the ratio of pension wealth to earnings wealth.

Pension Wealth Based On Firm-Reported Vs. Self-Reported Information.

In a number of data sets which have been used for analyzing retirement behavior, such as the Retirement History Survey and the National Longitudinal Survey, self-reported information on pension plans is all that is available. The SCF provides an opportunity to judge the accuracy of some of the self-reported information about pensions, in particular the ages of eligibility for early and normal benefits and the plan type, and the implied pension wealth values.

The first part of Table 5 considers the ages of eligibility for early and normal retirement for those individuals in the sample who reported both ages and who were covered by defined benefit or combination plans.[8] The self-reported ages are taken directly from the individuals' responses, while the firm-reported ages are calculated from the pension plan information as provided by the firm using the individuals' actual ages and dates of hire. For both the early and normal retirement ages, the median age reported by the individuals is the same as the median calculated from the actual plans. These ages are 55 for early retirement eligibility and 62 for normal retirement eligibility. The quartile values (not reported here) are also very close. However, for both the early and normal retirement ages, the mean age reported by the individuals is three to five years below the age calculated from the plans. Since the medians suggest that most individuals are fairly accurate about their ages of eligibility, the discrepancy in the means indicates that a few individuals are considerably overoptimistic.

The middle part of Table 5 tells a similar story with respect to pension wealth. The self-reported figures are calculated from responses to questions asking about each individual's expected annual benefit and

expected retirement date. The reported benefit is taken to be in nominal terms as of the expected retirement date. If the expected retirement date is prior to the date when the individual expects eligibility for full benefits, the reported benefits are presumed to be reduced from full benefits according to the reduction factors as reported in Hatch et al. (1982). Given the level of full benefits and applying the reduction factor for early retirement benefits, the value of the pension at the reported normal and early retirement dates is the discounted sum of payments from those date on, with allowance for partial inflation-related increases over time.

From the table, it is evident that the median pension wealth as calculated from the individuals' perceptions is close to the median wealth as calculated from the actual plan formula. Although not reported here, the first and third quartile values are not too far apart, suggesting that many individuals have fairly accurate assessments of their pensions. Again, however, the mean values indicate that there is a relatively small percentage of individuals who are considerably overoptimistic regarding the values of their pensions. This is consistent with the results in the top part of the table, since a sharp underestimate of the age of eligibility for a pension will result in a sharp overestimate of the value of the pension in calculations such as these.

The bottom part of the table assesses the effect of a weakness in the self-reported data. Specifically, the survey question asked the respondent to estimate the expected pension benefit at the date of retirement and allowed the response to be expressed either as a dollar amount or as a percentage of pay. For the responses in dollar amounts, it is impossible to be sure whether the amounts are in current dollars, in dollars as of the date of retirement, or something else. In order to eliminate this source of ambiguity, the bottom part of the table considers self-reported and firm-reported amounts only for that part of the sample whose self-reported amounts are expressed as a percentage of pay. The pension values of this

group are somewhat above the values for the sample as a whole, but the basic pattern of medians vs. means is repeated. The medians of the self- reported vs. firm-reported values are fairly close, but the means of the self-reported values are very high relative to the firm-reported values, again indicating that a few individuals are considerably overoptimistic about the value of their pensions.

Table 6 reports on the distributions of plans by plan type, as reported both by the individuals and the firms. The figures in the body of the table are percentages of column totals. These results suggest a substantial degree of confusion regarding plan type. Partly, this confusion may be the result of real ambiguity. For example, many plans which are basically defined benefit call for explicit contributions from workers and make provisions for the return of these contributions plus accumulated interest if the worker separates before retirement. Such plans have been labeled here as defined benefit, but the potential for confusion is clear. Keeping this caveat in mind, the table indicates that although the individuals are more likely to report the correct plan type than any other single plan type, incorrect reports are common. Even removing the effects of the don't knows, the coverage by a defined benefit plan is substantially understated in the self-reported data, falling well below the 88.1 percent of plans reported by the firms in the sample. In the case of coverage by defined contribution plans and by combination plans, the individual covered by such a plan is more likely to label the plan type wrong than right.

In sum, these findings should lead any user of self-reported pension data to exercise a great deal of caution. In particular, the researcher should be aware that although most individuals appear to have a fairly good idea of the value of their pensions, a small minority are considerably overoptimistic. This suggests that in dealing with self-reported data, it might be wise to give more weight to measures, such as the median and quartile values, which are not as sensitive to outliers as the mean.

Pension Wealth of Currently Employed Workers Vs. Retirees.

Another approach to calculating pension wealth in the literature uses information on pension receipt by current retirees (Allen and Clark, 1986). Table 7 presents such information for those retired pension recipients who are within the SCF sample. The mean pension wealth figure for current retirees is slightly over half of the figure reported in Table 1 for current pension-covered workers if they were to work to the normal retirement age, and over 80% of the figure if the current workers were to retire at the early retirement age. The lower pension wealth figures, of course, reflect at least to some extent the fact that the current retirees are members of earlier cohorts with lower lifetime earnings. Thus, with regard to the ratio of pension wealth to earnings wealth, the mean ratio among current retirees is 13.7%, which is greater than the projected ratio for current workers if they retire at the early retirement age but slightly less if they retire at the normal retirement age.

The median ratio of pension wealth to earnings wealth among current retirees is noticeably below the mean, moreso than among current workers if they work until the normal or early retirement age. This implies that the distribution of the ratios among the current retirees is more skewed than the projected distribution for current workers. It is possible that this finding reflects the fact that pension plans are currently required to distribute their benefits more evenly across workers than was the case when current beneficiaries were working.

Using Plan Characteristics To Infer The Value Of Pension Wealth.

The partial effects of plan characteristics on expected pension values may be deduced analytically for each plan formula. For example, consider the effect of reducing the age of eligibility for normal retirement benefits. If the plan is of the simple defined benefit type as described in Section II, this effect can be calculated simply by differentiating equation (1) or (2), as appropriate, with respect to the date of normal retirement

R. For equation (1), which applies if the individual has not already reached normal retirement age, this yields:

$$(6) \qquad dP(k)/dR = - r\,P(k)\,\{1 + 1/[1-e^{-r(D-R)}]\}$$

As would be expected, this expression is negative. The sooner the individual begins collecting unreduced benefits, the more valuable the pension. For an individual who is already eligible to collect normal retirement benefits, equation (2) is applicable. Since R does not appear in this equation, the differential is zero, as would be expected.

It is unlikely that a regression of pension values on typically observed plan characteristics such as R in the above example will yield unbiased estimates of the partial effects. This is because these effects may well be correlated with other characteristics which are typically not observed. For example, although many data sets dealing with pensions will inquire about the normal retirement age, few will inquire about the magnitude of the generosity parameter a in the benefit formula. If plans with relatively low retirement ages offset this by using a lower generosity parameter, a regression of pension values on retirement ages but excluding the generosity parameter will tend to underestimate the partial effect of the retirement age on pension values.

Even though such a regression is not expected to yield accurate estimates of partial effects, it may nonetheless be of interest if it is useful in imputing pension values in cases where only a set of pension characteristics is observed. Table 8 presents the results of regressions of the ratio of pension wealth to earnings wealth, computed at four different ages of retirement, on a number of key plan characteristics.[9] The calculations use the actual dates of birth and hire and the actual wages of the covered workers. Therefore, the estimated parameters in Table 8 reflect not only the direct effects of the included plan characteristics but also the effects of omitted plan and/or individual characteristics which happen

to be correlated with the included characteristics. The results suggest that certain plan characteristics are significantly and importantly related to the ratio of pension wealth to earnings wealth, conditional on retirement date. However, these characteristics of pension formulas do not explain more than a fifth of the variance in the ratio.

In the table, the last six variables are defined only for defined benefit and combination plans and take on a value of zero for defined contribution plans. This implicitly means that the reference defined benefit or combination plan is a pattern plan without social security offsets, maximum service years, or required contributions, and with a normal retirement age of at least 62 years regardless of service. In comparison with the reference defined benefit or combination plan, workers with defined contribution plans who retire at age 60 or older have ratios of pension wealth to earnings wealth that are 2.0 to 2.5 percentage points lower. Because most of the plan characteristics specific to defined benefit and combination plans tend to raise the ratio of pension wealth to earnings wealth above the levels for the reference defined benefit plan, the coefficients in the second row understate the overall difference between defined benefit and defined contribution plans. In the first row, we note that among all plans, those in multiemployer plans have ratios of pension wealth to earnings wealth that are 1.5 percentage points higher.

Among defined benefit and combination plans, it is apparent that as the findings from our earlier analysis suggested, the requirements for normal retirement are key characteristics. Plans which condition normal retirement at least partly on years of service (42.7% of the plans) and plans which condition only on age but with a normal retirement age below 62 (7.7%) tend to be more generous, especially for retirement at age 55 or 60. In that age range, these plans have ratios of pension wealth to earnings wealth which are 5 to 9 percentage points higher than the ratios for the rest of the covered workers, representing increases of 40 to 75 percent over the average value of the ratio. Two other plan characteristics are also associated with

more generous pensions. Social security offsets are associated with a 2 to 3 percentage point increase in the ratio of pension wealth to earnings wealth, and direct required contributions (as opposed to indirect contributions via a reduced wage) have similar effects. On the other hand, the presence of a maximum on service years is associated with a 1.5 to 3 percentage point reduction in the ratio of pension wealth to earnings wealth, with the reduction as expected being greater at later retirement ages.

VI. Incentives From Pension Plans.

To facilitate the analysis of incentives for mobility and retirement, pension profiles are calculated both for the actual sample individuals using the actual date of hire and the actual pension plan characteristics over time, and for a set hypothetical individuals corresponding to the actual individuals. The hypothetical individuals have the same wage residuals around the earnings equation as do the actual workers, and they are covered by the same plans. As before, nominal parameters in the plans are still assumed to grow with general wage growth, but other features of the plans are assumed to be those in place as of 1983 in order to focus better on the incentives actually provided by current plans. The main difference, however, is that the hypothetical individuals are assumed to have been hired at different ages than were the actual individuals in the sample.[10] Additional details on construction of the pension values for these individuals are presented in the Appendix.

Retirement Incentives.

The analysis of equation (4) suggests that because a pension payment is forgone, eventually work past normal retirement will reduce pension wealth, even if such work is credited in the standard way by the formula. Of course, if little or no credit is given for additional work or for the wage gains associated with continued employment, or if there is no actuarial

adjustment of any type, then the increment in pension wealth from postponing retirement will be further reduced.

Table 9 reports on the fraction of individuals who would qualify for early and normal retirement benefits at various ages, conditional on age of hire. The importance of provisions conditioning normal retirement on years of service is obvious from these data. One quarter of the workers could qualify for normal retirement benefits before the age of 60 if they were hired by age 25. Only 11% of this same group would qualify for normal retirement benefits before age 60 if they were hired at age 35, and virtually none would qualify if hired at age 45. These figures also highlight the importance of ages 60, 62 and 65 as the key ages for qualifying for normal retirement.

Table 10 reports, for various ages between 55 and 70, the mean ratios of pension wealth to earnings wealth (P/E) and the mean ratios of the increment in pension wealth to the wage ($\Delta P/\Delta E$) from working one more year. Reading down the first, third, and fifth columns, one can see that with continued work, pension wealth relative to earnings wealth rises in the early years and then declines in later years. Further, the peak ratio is at a later age the later the individual joins the firm. These patterns are also evident in the disaggregated results in Kotlikoff and Wise (1985, 1987), and Barnow and Ehrenberg (1979) offer a related discussion.

Comparing the ratios of incremental pension wealth to the wage in the second, fourth, and sixth columns of Table 10, it is apparent that plans generally provide lower incentives for older long-tenure workers to remain with the firm than for workers of the same age but less tenure.[11] The negative incremental pension wealth after qualifying for normal retirement benefits, as reflected in equation (4) above, is readily apparent in Table 10. For those hired at age 25, the negative increments commence at age 62, while for those hired at age 35 or 45, the negative increments begin at age 65. Moreover, the earlier the individual joined the firm, the bigger the marginal pension penalty from postponing retirement. For an individual who

joined the firm at age 25, the pension penalty from working at age 65 may be almost 25% of the wage. That is, instead of the pension adding 10% or more to compensation, as it does for work before normal retirement age, once the normal retirement age is reached, the pension subtracts almost a quarter of the wage from total compensation.[12] In future work, it will be of interest to determine how much of this effect is due to lack of crediting of work past normal retirement age, a practice that is now questionable under recent EEOC rulings.

Bulow and Kotlikoff and Wise have noted the sharp spikes in the net pension reward at ages of early and normal retirement. These are somewhat obscured in Table 10 because the ages of early and normal retirement differ among plans. To highlight the spikes created by the pension formulas, in Table 11 the ratios of incremental pension wealth to the wage are aggregated in a somewhat different way. The first column reports the average of the ratio in the fourth through second years preceding eligibility for normal or, if available, early retirement. The next three columns refer to plans for which the individual is offered an effective early retirement option. The second column indicates, for these plans, the average ratio of incremental pension wealth to the wage in the year immediately preceding the early retirement age, and the fourth column reports on the corresponding average ratio in the year immediately preceding the normal retirement age. The third column reports the average ratio in the remaining years (if any) between the early and normal retirement ages. The fifth column pertains to the year immediately preceding the normal retirement age for those plans not providing an effective early retirement option, and the final column refers to the mean ratio in the three years immediately following the normal retirement age. The table also provides figures separately for those plans with and without service requirements for normal retirement.

The top part of the table refers to the set of hypothetical individuals with three alternative hire ages. Most noteworthy here is the sharp spike from working the year associated with early retirement for the 84% of the

covered workers in plans that offer an effective early retirement option. For individuals hired at age 25, the increment in pension wealth associated with the year immediately preceding eligibility for early retirement amounts for over 75% of the wage earned in that year. This spike dominates the accrual path for these plans and greatly exceeds the spike at normal retirement for those plans which have early retirement provisions. When an effective early retirement option is not available, there is an enormous spike from working the year associated with normal retirement. All of these spikes appear to be considerably sharper for individuals with plans having service requirements for normal retirement.

The bottom part of the table examines the spikes for actual workers, using their observed ages of hire. These results are not very different from those found in the top part of the table for hypothetical workers hired at age 25, which is not very surprising given that the mean age of hire for the sample is 28.3 years.[13] The bottom part of the table also reports the quartile values. These figures support the emphasis of Kotlikoff and Wise not only on the average magnitude of the spikes but also of the variation among plans in the marginal incentives for continued work. The variation in incentives as indicated in these results suggests that information on plan type and dates of early and normal retirement specified in a plan are inadequate for determining the net reward from continued work very accurately.

Plan Characteristics And Retirement Incentives.

Retirement incentives may be sensitive to certain plan features. This sensitivity is illustrated in Table 12, which presents the results of several regressions. The dependent variable in these regressions is the ratio of the increment in pension wealth to the wage, and the explanatory variables are key plan characteristics. The dependent variable ratios are calculated at four different ages, one for each regression, and they refer to the actual workers with their observed ages of hire. The reader is

reminded that these estimates do not indicate the marginal incentive effect of each plan feature. Rather, they indicate the differences in incentives among individuals covered by plans with different features, plans which may also differ in ways that are not measured by the explanatory variables in the regression. As in Table 8, the last six characteristics pertain only to defined benefit and combination plans, and the reference defined benefit plan is a pattern plan without social security offsets, maximum service years, or required contributions, and with a normal retirement age of at least 62 years, regardless of service.

Notice first from the bottom row of the table that the ratio of the incremental pension wealth to incremental earnings wealth is, as suggested above, positive at ages 55 and positive but substantially lower at age 60. At 65 and at 70, the ratio of the increments is strongly negative. Compared to defined contribution plans, reference defined benefit and combination plans provide a higher relative reward to continued work at 55 and 60 and a lower one at 65 and 70. The key plan feature affecting the relative reward for continued work is the eligibility requirement for normal retirement benefits. For plans without service requirements and with a normal retirement age less than 62 (7.7% of the sample), the increment in pension wealth is lower by about 20% of the wage for work at age 60 and beyond. For plans with service requirements for normal retirement (42% of the sample), pension penalties reduce compensation by 12.4% of the wage for work at age 60, 3.4% at 65, and 9% at 70. Plans with social security offsets and plans with required contributions have larger pension increments for work at ages 55 and 60, while offering smaller relative rewards at 65 or 70. As expected, for those covered by plans which impose maximum values on the number of years of service which may be credited, relative increments are significantly less, especially for work at age 65.

Incentives For Mobility.

In analyzing the incentives that pensions create for mobility, it is

necessary to consider the loss in pension value from leaving the current job. The total loss is simply the sum of the incremental pension values that the individual would gain in the current job until retirement if he were to stay in that job. To understand the mobility decision, the loss must be weighed against the potential wage gains in the next best alternative job relative to the current job.[14]

Table 13 reports the increments in pension wealth, relative to the wage, from remaining one more year on the job. These figures are presented at five-year intervals for three different hypothetical ages of hire and are disaggregated according to requirements for normal retirement.[15] A rough idea of the increase that would be required in compensation in a new job relative to the wage in the current job in order to offset the pension loss can be obtained by averaging the figures in the table between the current age and the expected separation date.[16] For example, an individual who started at age 25 in a pension job with service requirements for normal retirement, who is currently 45, and who expects retirement in the mid 50's would require around a 20 to 25 percent increase in compensation in a new job over the current job wage in order to make up for the lost pension. If the same individual expected to stay in the current job until 60, however, the required increase in compensation would be lower, at roughly 15 to 20 percent.

In general, plans appear to provide the strongest incentives against mobility if the normal retirement age in the plan matches the age the individual would like to leave the firm. Among plans without service requirements, those with an age requirement below 62 provide much stronger incentives against mobility if the individual wishes to retire earlier rather than later, with just the opposite for those plans with an age requirement at or above 62. Plans with service requirements lie somewhere in between but closer to those with age requirements below 62.

For an individual who intends to retire at age 60, the top part of Table 14 provides more precise measures of the increase in compensation in the new

job which would be required to make up for the pension loss. As expected from the discussion in the last paragraph, pension plans with service requirements or with normal retirement ages less than 62 generally provide stronger incentives against mobility than do plans which have a required age of 62 or more, at least for an individual who wants to retire at the relatively early age of 60. The exception is for longer service workers who are 55 and who may already be eligible for relatively favorable early or even normal retirement benefits. For these individuals, the current eligibility for favorable benefits means that the increments in pension values between 55 and 60 are small.

The bottom part of Table 14 is presented to indicate the sensitivity of the calculations to an important assumption in the analysis, namely, the level of the inflation and discount rates. The figures here are calculated for inflation and discount rates which are five percentage points higher than those used in the rest of the paper. As might be expected, the fact that pension benefits are only partially indexed once they are started reduces the magnitude of pension values and increments at higher inflation and discount rates. However, the pattern of benefits is much the same under either set of assumptions. Though not reported here, the figures in Table 13 respond in similar fashion to higher inflation and discount rates.

The Gains From Joining A Plan Early.

Ippolito (1986) suggests that pension characteristics will affect not only the cost of terminating employment, but also the net reward for joining a firm at a particular age. Accordingly, it is of interest to calculate the variation in the pension with date of hire. Consider, for example, the effect of joining a plan early for a person who will leave before the date of normal retirement. Differentiating equation (1) with respect to j, we have

$$(7) \qquad dP(k)/dj = -P(k) / (k-j)$$

Pension increases from joining the firm earlier reflect the effects of the proportionate increase in tenure, but do not also reflect the effect of wage growth. Thus for a person who will leave before normal retirement age, the proportionate effect on the pension from joining the firm one year earlier is less than the proportionate effect of leaving one year later.

Table 15 considers the gains in pension wealth from joining a plan earlier. The first, second, fourth and sixth columns report the mean ratio of pension wealth to earnings wealth for individuals who are hired at various ages. The remaining columns report the mean ratio of the gains in pension wealth from joining the firm five years earlier relative to the wages that would be earned in that time. For example, for a worker retiring at age 50, the mean difference in pension values from joining the firm at 25 rather than 30 is 8.9% of the wage that would be earned between 25 and 30. For workers retiring at 50, there are only modest marginal gains from joining the firm five years earlier. For a worker retiring at age 55, these gains are sharpest from joining at age 25 rather than 30, with the mean difference in pension values being 15.7% of the wages over the period. For workers retiring at later ages, the gains from joining early decline, with the gains for these individuals being greatest for joining at age 35 rather than 40.

The top part of Table 15 reports the ratios for all plans, and the bottom part reports the ratios only for those plans with service requirements for normal retirement. The pattern of the results in the two parts of the table are similar, although the percentages for plans with service requirements are generally a point or two higher. The most noticeable difference is that if a worker covered by a pension with service requirements is planning to retire at age 55, it is extremely valuable to begin work by age 25. Conditional on leaving at age 55, the marginal gain from starting at age 25 rather than 30 is to raise pension wealth by 22.5% of the value of the wages over that five year period.

VII. The Relation of Pension Values To Union Status, Gender and Race.

This section analyzes disaggregated results on pension wealth and incentives created by pensions. The categories considered are union status, gender and race. These have been the subject of previous research, and are of interest for both behavioral and distributional reasons.

Pension Differences by Union Status.

Previous research suggests that unions may introduce a unique set of motivations for pensions, such as the goal of redistributing union monopoly rents among generations. Available empirical work provides mixed evidence as to the impact of union on pension values. Freeman (1985) suggests that unions raise pension values by increasing pension coverage, but that conditional on pension coverage, unions affect firm contributions only to the extent that they raise wages, and higher wages are accompanied by higher pensions. Allen and Clark (1986, p. 512) find that retired union workers receive higher pensions than do nonunion workers, with most of the difference due to differences in years of service, salary history and post retirement adjustments. Gustman and Steinmeier (1986c) find that plan characteristics differ systematically between union and nonunion workers. These differences in plan characteristics could be associated with systematic differences in pension values, or with differences in marginal increments in pension wealth.[17]

In Table 16, the first two columns report that conditional on retirement at age 65 or at the normal retirement age of each plan, mean pension wealth for union workers with defined benefit plans is below that for nonunion workers, and the same is true for mean earnings wealth. The lower wealth levels among union workers may arise because the group of nonunion workers is more likely to include individuals toward the high end of the wage distribution among all nonunion workers. The lower wealth levels of union workers with pensions is <u>not</u> attributable to a few extreme cases among the nonunion group, however, since the median figures (not reported in the

table) tell much the same story. The average ratio of pension wealth to earnings wealth is also somewhat lower, by about two percentage points, for union workers than for nonunion workers.[18]

Table 17 reports the results of three regressions, one for each of three potential retirement ages, of the ratio of pension wealth to earnings wealth on a set of individual and firm characteristics. The second row reports the partial effect of union coverage and suggests that unions have an insignificant, negative effect. Notice also that the coefficient of the union variable becomes more negative as the age of retirement is extended. Regressions using other dates of hire and termination produce similar results. These results, taken together with those from our earlier studies, support Freeman's finding emphasizing that the union impact on pension values operates mainly by increasing coverage.[19]

Table 18 reports on a similar set of regressions, one for each year over a 15 year age range, using the ratio of the incremental pension to the wage as the dependent variable. The second column focuses on the differences unions make to benefit accruals.[20] In this age range, union pensions accrue significantly more slowly relative to earnings than do nonunion pensions. As a result, union pensions encourage earlier retirement. While the regressions in Table 18 are confined to defined benefit and combination plans, similar results are obtained with only a slightly smaller effect of unions when the same relations are fit to a sample which includes all plans.

Pension Differences by Gender.

In the Survey of Consumer Finances, the pension coverage rate for employed women is 41%, while for men it is 64%.[21] In regressions with occupation, industry and individual characteristics included as explanatory variables, women are 12.5% less likely than men to be covered by a pension, and conditional on having a pension, women are 1.2% more likely than men to have a defined benefit plan (Gustman and Steinmeier, 1986b). From Table 16, the male-female gap in pension wealth for those covered by a defined benefit

plan is less than 5 percent.[22] Since the corresponding gap in real earnings is 18 to 20 percent, the ratio of pension wealth to earnings wealth for females averages 1.7 to 1.9 percentage points above the comparable ratios for males. In comparison, McCarthy and Turner (1983), using data for retired workers, find the share of pensions in compensation for pension covered workers to be one third greater for women than men. From Table 17, the gap as estimated in a multivariate analysis is slightly below these figures for retirement at age 65. For retirement at age 55 or 60, the male-female difference in the ratio of pension wealth to earnings wealth is not statistically significant.

As can be seen in Table 18, the defined benefit pension plans covering women provide significantly larger marginal rewards for continued work in the 55 to 70 age range than do the defined benefit plans covering men. Thus on balance pensions encourage women to defer retirement more strongly than they do men. Consistent with this result, our earlier work suggests that plans covering women are 5.7% less likely to base normal retirement on years of service.

Pension Differences By Race.

Of those currently employed in our SCF sample, 59.3% of blacks and 62.2% of nonblacks are covered by a pension. In an earlier multivariate analysis, we found that black-nonblack differences in the probability of pension coverage are associated with differences in individual, industry and occupational characteristics, but not with race per se (Gustman and Steinmeier, 1986b). Table 16 here reports that allowing for differential life expectancy by race, pension wealth for blacks who are covered by defined benefit plans is 28% to 34% below the comparable figure for nonblacks. This gap is somewhat smaller than that in Lazear and Rosen (1987). The earnings differentials are slightly less than the pension wealth differentials by race, so that the ratios of pension wealth to earnings wealth for blacks are 0.5 to 1.3 percentage points below those for

nonblacks. From Table 17, in regressions explaining pension wealth ratios among those covered by defined benefit plans, a dummy variable indicating race is not statistically significant. Nor is the indicator of race significant in the regressions in Table 18 explaining ratios of increments in pension wealth to increments in earnings wealth for continued work at each age from 55 to 70.

VIII. Implications and Conclusions.

This study has presented new estimates of pension wealth and of the incentives created by pensions. The SCF has been crucial to this effort, uniquely combining information on the labor market experience of each individual with firm-provided data on pensions. Using this data set, we have also tried to assess the validity of previous efforts to estimate pension values from incomplete data of the kind typically found in other data sets.

With regard to this last point, we find some encouraging results for users of previously available data sets. For example, reasonable measures of pension wealth can be calculated from samples of pension formulas as long as the wage used is representative for the covered workers. Also, pension wealth can be roughly inferred from self-reported data as long as measures such as the median are used and care is taken to eliminate the influence of potential outliers on the results. Finally, our findings support Freeman's conclusion, based on data from firm contributions to pension plans, that the union impact on pension wealth occurs mainly through the union effect on coverage and the feedback from the union monopoly effect on the wage.

Our findings also have important implications for theories trying to explain the existence of pensions and the forms they take. Any such theory or combination of theories must confront a multitude of differences in the incentives provided by different plans to different individuals. From Table 13, for example, incremental pension values for an individual at age 60 with 35 years of service range from a supplement equal to 12.8% of the wage to a

penalty equal to 0.6% of the wage, depending on the requirements for normal retirement. Among those covered by plans with service requirements, an individual with 30 years of service receives a supplement of 12.2% of the wage if he joined the firm at age 25 but a penalty of 16.9% of the wage if he joined at 35. Similarly, a 60 year old covered by such a plan receives a supplement of 15.9% if he joined at 45 but a penalty of 0.6% if he joined at 25. Consideration of variances means that there are even more differences among the incentives provided by different plans to different individuals than the above numbers imply.

There are several productivity-related explanations for pensions, all of which turn on the inability of employers to reduce wages to induce retirement at an optimal time. The simplest is that pensions induce optimal retirement given the demands of jobs (Parsons, 1983). We know that retirement occurs earlier from more as opposed to less physically difficult jobs (Gustman and Steinmeier, 1986a), which could explain differences in incentives across employers. However, if firms induce workers to retire simply because of declining productivity, why are individuals of the same age sometimes treated so differently according to their age of hire? This leads to a second explanation for pensions, that they are arranged to permit specific human capital investment by providing the workers with sufficient incentives against mobility to allow the expense of the investment to be recovered. If this were true, however, why would the incentives to retire be so much stronger for an individual with 30 years of service hired at age 25 than for one hired at 35? It would seem that the individual hired earlier would have a longer work horizon until any kind of age-related motive to retire, and this would provide incentives for investment in longer-duration specific human capital. This would lead one to expect that a younger individual with 30 years of service should be given more, not fewer, incentives to remain with the firm than would an older individual with the same level of service.

A third productivity-related explanation for pensions is that they

induce individuals not to "shirk" in their jobs. This explanation fails to explain the age patterns presented above, however, and additionally it has some problems of its own with observed patterns. In Table 14, it is observed that the pension loss from retiring at a given age rather than age 60 is a relatively constant proportion of the cumulative earnings over the interval. This implies that the magnitude of the loss, which is a measure of the incentives against shirking, is likely to be declining in the years immediately before retirement. It is not at all clear why firms require fewer incentives against shirking for individuals near retirement than they do for individuals in the middle of their careers. This is especially true because although firms may not have realistic options for terminating workers guilty of minor shirking, they can shunt the worker onto tracks with fewer promotion possibilities and lower raises. This will be more costly to the worker the earlier it happens, and it means that the firms already have potent threats against shirking by middle age workers, but less potent threats against the same behavior by older workers.

Development of some plausible behavioral rationale for the existence of pensions and for the forms they take would enhance our understanding of the long term employment relation and might provide further justification for one or another of the approaches for evaluating pensions. Further, if reasonable behavioral models can be established, the effects on productivity, employment and compensation of the sweeping regulatory changes regarding pensions can be better understood. Examples of these are the abolition of mandatory retirement, EEOC rulings requiring crediting of work past the age of 65 in computing pension benefits, changes in the social security benefit structure to make it actuarially more fair, proposals to increase pension portability by reducing pension backloading, and proposals to extend pension coverage further.

To date, these changes in pension policy have probably not had a severe impact on retirement behavior. The continued fall in the age of retirement suggests that in many cases, the constraints created by these regulations

have not been binding. However, the redundancy of mandatory retirement, pension and social security policies has been eliminated. Moreover, the combination of demographic trends and the prescription of limitations which are further from market solutions should make the constraints more likely to bind, at least for some workers. Given recent changes in the law, pensions are the only tool now available, short of mandatory competency testing, for firms to influence retirement behavior. In this scenario, only after the behavior of firms and workers are better understood will we be in a position to evaluate the labor market effects of many of the recent and proposed changes in pension policies.

Footnotes

1. A pattern plan, also called a flat benefit plan, is another type of defined benefit plan. Under a pattern plan, yearly benefits are set equal to some dollar figure multiplied by years of service. The analysis will be applicable to pattern plans as long as the dollar amounts in the plans are revised in accordance with the growth in the wage over time. Kotlikoff and Wise (1987) assume, consistent with the assumption made in this analysis, that the dollar amounts are revised; on the other hand Fields and Mitchell (1984) and Lazear and Moore (1985), calculate pension profiles as if the dollar figures remain fixed. When the dollar amounts are fixed, the effect of postponing exit from the firm is to cause the value of the plans to decline relative to the value of a final average salary plan.

2. Barnow and Ehrenberg (1979) analyze the effects on pension costs of using different formulas to calculate average salary.

3. It is straight forward to modify the results by including life tables. For example, see Barnow and Ehrenberg (1979). Life tables are included in our empirical analysis below.

4. If there is cliff vesting, the value of the pension will be zero during the vesting period and will equal the value indicated in equation (1) thereafter up to the date of normal retirement eligibility. This will create a spike at vesting in the profile represented by equation (3). For further discussion, see Kotlikoff and Wise (1985).

5. In previous work, we found a coverage rate of 54.4% for the full SCF sample. Descriptive statistics and a multivariate analysis of determinants of the coverage rate are presented in Gustman and Steinmeier (1986b).

6. Lazear and Moore (1985) emphasize that work in a particular period may be a condition for eligibility for a benefit at the end of work in some subsequent period. If there is a sharp jump in the reward for work in a subsequent year, for instance at early and normal retirement age, the value to the worker of employment in an earlier year, or the cost to the firm, may exceed the value indicated by equation (3). Lazear and Moore call this the option value of the pension.

7. Tests of some possible restrictions may be found in Kotlikoff and Wise (1985) and Ippolito (1985).

8. The figures pertaining to early retirement in the upper two parts of Table 5 are based on 155 observations. Those for normal retirement are based on 154 observations. The figures in the bottom part of the table are based on 27 observations.

9. For an analysis of the relation of each of these plan characteristics to worker and firm characteristics, including union status, see Gustman and Steinmeier (1986b).

10. The hypothetical individuals are all assumed to have been born in 1958. However, since the plan characteristics (except nominal amounts) for these individuals are treated as constant over time, changing the date of birth while holding the age of hire constant will have the effect primarily of shifting all of the nominal values up or down proportionately, with little effect on the ratios reported in the tables.

11. The ratios of incremental pension wealth to the wage in this table and in subsequent tables are adjusted to remove the portion of the growth in pension wealth due to the interest on the stock of pension wealth accumulated through the previous period. That is, the reported growth rate of the pension does not reflect the impact of the interest rate term in equation (3). In addition, the ratios are adjusted to remove the effect of longer life expectancy from having survived an additional year. For a perceptive discussion of the determinants of pension accrual, see Bulow (1982).

12. Kotlikoff and Wise (1987) emphasize that early retirement provisions impose less than actuarially fair benefit reductions. They find that for plans which specify different ages for early and normal retirement, the decline in the rate of pension accrual at the age of early retirement is considerably less than at the age of normal retirement. Bulow (1981) has carefully analyzed the effects of such incentives on the rate of cumulation of pension benefits, emphasizing that early retirement provisions which are less than actuarially fair will raise the accrual rate substantially for work in the earlier years, and reduce substantially the reward for work once the early retirement age has been reached. Bulow's example, created for a defined benefit plan with normal retirement at age 65, indicates how sharply benefits to work past early retirement age may be reduced by the availability of early retirement benefits.

13. To expand the analysis of the impact of missing data, we also calculated these spikes (using the actual date of hire) with the geometric mean of the sample wage or the average wage in the two-digit industry as the base period wage for each observation. The numbers obtained are very close to those reported in Table 11.

14. In Gustman and Steinmeier (1987) the SCF data are used to estimate the incentives for mobility and the effects of these incentives on actual mobility behavior. That study indicates that the effect of pension incentives on mobility, and especially the effect of backloading of pensions, is minor compared to the effect of the wage premium received by those on pension covered jobs over the wage in the next best alternative job.

15. The normal retirement date is specified as the earliest date at which the normal retirement formula gives positive numbers, taking into account the explicit age and service requirements associated with each subformula. In a particular plan, positive benefits may be realized before age 62 for an early hire, but not for a late hire, e.g., if there is a substantial social security offset. In such a case, the plan is classified as having a normal retirement age below 62 when the individual is hired early, but not later. This accounts for the changes in the number of cases observed with changing age of hire in columns 1 and 2.

16. For simplicity, our discussion assumes that the individual can always stay until normal retirement. For a more general discussion of pension costs under circumstance where turnover is uncertain, see Lazear and Moore (1985).

17. In particular, unions increase the fractions of plans which are defined benefit and which have service requirements for normal retirement, and they reduce the fractions of plans which have social security offsets and which use final average salary in determining benefits. The results presented in Table 8 above suggest that all four of these characteristics are associated directly with higher ratios of pension

wealth to earnings wealth. As a result, the impact of unions on this ratio is indeterminate on the basis of these plan characteristics alone. Analogously with regard to Table 12, direct analysis is required to determine whether unions systematically affect the marginal reward from pensions among covered workers.

18. These estimates assume that union and nonunion workers will experience the same post-retirement benefit adjustment, an assumption that probably understates the union-nonunion difference in pension values.

19. We also ran equations which employ a specification analogous to Freeman's, with pension wealth on the left hand side and earnings wealth on the right. The coefficient on the union variable is negative but insignificant in each of the equations. Similar results are obtained whether the regressions are run for defined benefit and combination plans only, or for all plans. One further result from these regressions should be noted. The significant, positive coefficient on the indicator that years of schooling exceeds 16 suggests that the rate of return to schooling is underestimated when pensions are ignored. In addition, there is the positive, significant impact of years of schooling on the probability of pension coverage (Gustman and Steinmeier, 1986b), which will increase the size of the underestimate.

20. As before, the numerator of the dependent variable in Table 18 nets out pension increments which are due simply to longevity.

21. These coverage rates are higher than those found by Lazear and Rosen (1987) for males and somewhat lower for females. Our findings pertain to full-time workers who are either a head of household or the spouse of the head. Lazear and Rosen's results pertain to all workers.

22. The gap in pension wealth is much smaller than in Lazear and Rosen (1987), perhaps due to the differences in sample composition noted above. In the calculation of annuitizing factors for plans specifying actuarial reductions, and consistent with the law at the time of the survey, differences in life expectancy between males and females are taken into account.

Table 1
Wealth from Pensions and Net Wealth from Earnings
Assuming Work to the Indicated Time of Separation[a]

	Time of Separation					Plan Retirement Age	
	Age 55	Age 60	Age 65	Age 70	1983	Early	Normal
DB & Combination Plans							
Pension Wealth							
Mean	87	115	134	115	20	87	135
Standard Deviation	137	181	245	252	58	133	243
First Quartile	26	40	55	50	0	30	54
Median	62	91	100	81	1	68	103
Third Quartile	119	144	158	126	17	113	159
Earnings Wealth							
Mean	728	887	1050	1212	287	719	933
Pension-Earnings Ratio							
Mean	10.9%	12.4%	12.5%	9.1%	3.8%	12.0%	14.3%
Standard Deviation	8.0	7.9	6.8	5.7	6.4	8.3	7.8
First Quartile	5.4	7.4	8.1	5.6	0	6.8	9.0
Median	9.9	11.6	11.7	8.1	0.8	10.6	13.8
Third Quartile	14.8	16.0	15.8	10.9	4.7	15.1	18.1
Number of Observations	528	530	530	530	530	530	530
Defined Contribution Plans							
Pension Wealth							
Mean	45	58	73	85	19		
Standard Deviation	51	64	81	92	17		
First Quartile	12	18	25	29	0		
Median	35	43	52	65	3		
Third Quartile	56	73	89	104	9		
Earnings Wealth							
Mean	607	751	915	1082	160		
Pension-Earnings Ratio							
Mean	7.0%	7.1%	7.5%	7.5%	3.5%		
Standard Deviation	4.7	4.8	4.9	4.9	4.4		
First Quartile	3.6	3.5	3.8	3.9	0		
Median	6.0	6.2	6.6	6.6	2.0		
Third Quartile	9.4	9.5	9.7	9.8	5.6		
Number of Observations	48	49	49	49	49		

[a]Wealth figures are in thousands of 1983 dollars. Amounts are estimated using plan formulas reported by the firm and the covered worker's actual date of birth and date of hire.

Table 2
Pension Wealth from Current Job
Under Alternative Assumptions About Turnover[a]

	Turnover Rate		
	0%	2%	4%
Total Pension Wealth Assuming Work to Normal Retirement	134	108	89
Prorated Pension Wealth from Work to Date	47	42	39

[a]Wealth figures are in thousands of 1983 dollars.

Table 3
Mean Ratios of Pension Wealth to Earnings
Wealth for Defined Benefit and Combination Plans[a]

	Tenure				
Age	0-10	11-20	21-30	>30	All
25-34	0.6% 14.1				0.8% 14.0
35-44	0.5 14.4	3.4% 13.6			2.2 14.0
45-54	1.5 13.6	8.9 18.1	10.4% 15.8		7.5 15.6
55-64	4.4[b] 13.3[b]	11.4[b] 16.5[b]	11.6[b] 14.1[b]	12.8%[b] 13.7[b]	10.2 14.5
65-74	-- --	9.4[b] 12.3[b]	-- --	-- --	9.4[b] 12.3
All	0.8 14.0	5.4 14.6	9.8 15.2	12.1 13.6	3.8 14.3

[a]The top figure in each pair assumes exit in 1983. The bottom figure assumes retirement at the normal retirement age.

[b]Fewer than 25 observations.

Table 4
Ratios of Pension Wealth to Earnings Wealth for Various Wage Assumptions, Conditional On Retirement at the Normal Retirement Age

Measure of Pension-Earnings Ratio	Base Wage Used In The Pension Formula: Actual Wage	$10,000	$25,000	$50,000	Mean of Log Wage for the SCF	Mean of Log Wage for the Two Digit Industry
Mean	14.3%	16.0%	13.5%	12.8%	14.3%	14.2%
First Quartile	9.0	10.8	7.5	5.3	9.1	9.1
Median	13.8	15.6	13.3	12.5	13.8	13.8
Third Quartile	18.1	19.9	18.1	18.1	17.9	18.0

Table 5
Self-Reported Vs. Firm-Reported Pension Data On Retirement Ages and Pension Values

	Self-Reported Mean	Self-Reported Median	Firm-Reported Mean	Firm-Reported Median
Early Retirement Age	52.0	55	55.0	55
Normal Retirement Age	56.4	62	61.5	62
Value of Pension[a]				
	All Individuals With Self-Reported Pensions			
At Early Retirement Age	136	66	88	67
At Normal Retirement Age	176	100	131	101
	Individuals With Self-Reported Pensions Expressed As Percentage of Pay			
At Early Retirement Age	208	105	118	111
At Normal Retirement Age	301	115	177	131

[a]In thousands of 1983 dollars.

Table 6
Individual Vs. Firm Responses on Plan Type

Individual's Response	Firm Response: Defined Benefit	Firm Response: Defined Contrib.	Firm Response: Combination	All Plans
Defined Benefit	62.7%	28.6%	35.0%	58.9%
Defined Contribution	4.5	36.7	10.0	7.4
Combination	17.1	10.2	40.0	17.3
Don't Know	15.7	24.5	15.0	16.4
Number of Observations	510	49	20	579
Percent of Observations	88.1%	8.5	3.5	100

Table 7
Pension Wealth for Current SCF Retirees[a]

Pension Wealth	
Mean	71
Standard Deviation	63
First Quartile	27
Median	48
Third Quartile	103
Pension-Earnings Ratio	
Mean	13.7%
Median	9.8
Number of Observations	158

[a]Wealth figures are in thousands of 1983 dollars.

Table 8
Relation of Plan Characteristics to the Ratio of Pension Wealth to Earnings Wealth, Using Actual Age of Hire[a]

Plan Characteristics	Mean	Age of Retirement 55	60	65	70
Multiemployer Plan	.227	0.003 (0.43)	0.015 (2.20)	0.013 (2.15)	0.013 (2.63)
Defined Benefit or Combination Plan	.916	-0.003 (-0.23)	0.021 (1.58)	0.025 (2.08)	0.020 (1.96)
Service Requirements for Normal Retirement	.426	0.050 (7.64)	0.051 (7.86)	0.024 (4.12)	0.018 (3.69)
Age Requirement Only, Required Age < 62	.077	0.091 (7.81)	0.069 (5.87)	0.024 (2.29)	0.008 (0.92)
Final Average Pay Plan	.754	0.011 (1.24)	-0.004 (0.46)	0.010 (1.27)	0.002 (0.26)
Social Security Offset Plan	.420	0.020 (2.91)	0.030 (4.45)	0.028 (4.52)	0.016 (3.14)
Plan with Maximum on Service Years	.660	-0.013 (1.87)	-0.016 (2.27)	-0.015 (2.54)	-0.031 (5.93)
Plan with Required Contributions	.166	0.024 (2.92)	0.034 (4.28)	0.027 (3.80)	0.021 (3.46)
Constant		0.068 (6.64)	0.065 (6.43)	0.070 (7.68)	0.069 (9.02)
R^2		0.207	0.216	0.171	0.145
Number of Observations		573	579	579	579
Mean Pension-Earnings Ratio		0.107	0.120	0.121	0.090

[a]All variables are binary variables with a value of one if the designated characteristic is present in the plan and zero otherwise. Absolute t- statistics are in parentheses.

Table 9
Percent Eligible for Normal Retirement
in Defined Benefit and Combination Plans

Age of Retirement	Age of Hire 25	35	45
55	22.3%	9.4%	0.2%
56	22.5	10.5	0.2
57	22.5	10.5	0.2
58	24.9	11.0	0.2
59	26.0	11.0	0.2
60	36.3	25.0	9.7
61	37.1	25.8	11.3
62	55.1	49.7	33.3
63	55.7	51.8	34.4
64	55.8	51.8	34.8
65	100	100	100

Table 10
Mean Ratios of Pension Wealth to Earnings Wealth and
Ratios of Increments in Pension Wealth to Wages
in Defined Benefit And Combination Plans

Age of Retirement	Age of Hire 25 P/E	25 ΔP/ΔE	35 P/E	35 ΔP/ΔE	45 P/E	45 ΔP/ΔE
55	12.1%	12.3%	10.7%	16.7%	8.4%	17.1%
56	12.2	11.1	11.2	16.1	9.3	13.4
57	12.3	11.1	11.6	17.1	9.8	14.1
58	12.4	8.8	12.0	15.5	10.3	15.1
59	12.4	13.1	12.3	24.2	10.8	29.3
60	12.6	4.8	13.0	11.3	12.3	15.1
61	12.6	10.1	13.1	16.9	12.7	20.6
62	12.7	-1.4	13.5	6.8	13.4	11.8
63	12.5	-3.1	13.5	3.3	13.6	11.2
64	12.2	2.4	13.3	7.4	13.7	14.0
65	12.2	-24.0	13.3	-16.8	14.0	-8.6
66	11.5	-24.2	12.5	-16.7	13.0	-8.7
67	10.8	-24.5	11.7	-16.9	12.2	-9.0
68	10.1	-25.4	11.0	-17.8	11.4	-10.0
69	9.5	-25.7	10.3	-18.0	10.7	-10.1
70	8.9	-28.0	9.7	-20.2	10.0	-12.3

Table 11
Ratio of Increment in Pension Wealth to the Wage
Associated with Early and Normal Retirement Provisions

		Plans with Early Retirement			Plans without Early Retirement	
	Pre-retirement	ER Spike	Early Retirement	NR Spike	NR Spike	Normal Retirement
A. Using Hypothetical Alternative Ages of Hire						
Age of Hire						
				All Plans		
25	15.6%	75.1%	16.4%	26.2%	193.5%	-12.6%
35	14.5	53.9	14.9	26.4	92.4	-7.3
45	9.1	71.5	14.2	24.0	46.8	-4.3
				Plans with Service Requirements for Normal Retirement		
25	16.2	118.6	18.5	38.9	210.9	-9.7
35	15.2	76.5	16.1	38.1	126.9	-4.4
45	10.6	87.4	15.4	34.5	51.8	-1.1
				Plans without Service Requirements for Normal Retirement		
25	15.1	45.1	15.0	17.4	118.0	-15.1
35	13.9	34.6	14.0	16.5	53.8	-9.9
45	7.9	59.2	13.2	15.8	39.0	-7.2
B. Using Actual Hire Dates						
Measure						
				All Plans		
Mean	15.5	74.2	15.4	24.4	171.3	-10.6
1st Quartile	7.1	14.8	6.8	3.2	46.3	-17.0
Median	12.6	32.6	14.6	11.9	151.2	-7.2
3rd Quartile	19.8	106.9	21.7	26.1	267.1	-0.8
				Plans with Service Requirements for Normal Retirement		
Mean	15.7	111.8	17.4	35.3	220.6	-7.6
1st Quartile	8.0	23.3	7.9	4.0	128.2	-14.2
Median	12.6	67.3	17.1	15.9	211.7	-5.6
3rd Quartile	18.1	170.5	24.5	33.6	303.1	-0.1
				Plans without Service Requirements for Normal Retirement		
Mean	15.3	45.0	13.9	15.9	75.7	-13.3
1st Quartile	6.6	10.2	6.5	2.6	32.4	-20.1
Median	12.7	22.8	12.7	10.7	47.2	-8.6
3rd Quartile	20.8	46.8	20.4	22.8	71.6	-1.8

Table 12
Relation of Plan Characteristics to the Ratio of the Increment in Pension Wealth to the Wage Using Actual Age of Hire

Plan Characteristics	Age 55	60	65	70
Multiemployer Plan	0.011	0.019	0.026	0.029
	(0.56)	(1.19)	(1.44)	(1.70)
Defined Benefit and Combination Plan	0.045	0.054	-0.049	-0.113
	(1.21)	(1.76)	(1.44)	(3.43)
Service Requirements for Normal Retirement	0.022	-0.124	-0.034	-0.090
	(1.22)	(8.21)	(2.03)	(5.52)
Age Requirements Only, Required Age < 62	-0.040	-0.219	-0.235	-0.194
	(1.22)	(8.14)	(7.84)	(6.70)
Final Average Pay Plan	-0.014	0.017	-0.066	-0.017
	(0.56)	(0.84)	(2.82)	(0.75)
Social Security Offset Plan	0.083	0.057	-0.054	-0.045
	(4.37)	(3.64)	(3.07)	(2.65)
Plan with Maximum on Service Years	-0.017	-0.038	-0.128	-0.057
	(0.91)	(2.42)	(7.28)	(3.37)
Plan with Required Contributions	0.058	0.028	-0.028	-0.047
	(2.59)	(1.50)	(1.38)	(2.38)
Constant	0.062	0.060	0.033	-0.013
	(2.19)	(2.55)	(1.28)	(-0.50)
R^2	0.076	0.199	0.313	0.257
Number of Observations	573	579	579	579
Average $\Delta P/\Delta E$	0.135	0.061	-0.200	-0.240

Table 13
Ratio of One-Year Increment in Pension Wealth to the Wage, by Age at Hire

	Requirements for Normal Retirement		
	Age Only, Age < 62	Age Only, Age > 62	Service Requirement
Age		Hired at Age 25	
35	7.8%	6.1%	5.5%
40	12.0	5.6	7.0
45	17.9	8.0	11.3
50	27.0	11.3	22.1
55	8.9	13.1	12.2
60	-6.6	12.8	-0.6
65	-39.9	-19.6	-25.1
70	-36.8	-21.9	-32.1
Number of Observations	48	235	246
Age		Hired at Age 35	
45	14.3%	10.7%	9.5%
50	22.0	10.2	12.4
55	10.3	13.4	20.9
60	0.2	14.6	9.7
65	-30.9	-14.5	-16.9
70	-27.4	-16.4	-22.9
Number of Observations	38	245	246
Age		Hired at Age 45	
55	16.0%	17.8%	16.3%
60	6.1	14.7	15.9
65	-0.6	-9.4	-8.0
70	-11.2	-10.6	-14.3
Number of Observations	10	273	246

Table 14
Mean Ratio of Loss in Pension Wealth to Loss in Earnings Wealth from Separation at Indicated Age Instead of Remaining to Age 60

Age	Requirements for Normal Retirement: Age Only, Age < 62	Age Only, Age > 62	Service Requirement
A. At Historical Inflation and Discount Rates			
		Hired at Age 25	
35	16.6%	10.2%	15.9%
40	18.4	11.4	18.2
45	19.8	13.0	21.6
50	19.5	15.0	24.3
55	5.2	13.5	9.9
		Hired at Age 35	
45	17.5	12.3	18.1
50	18.0	14.1	21.6
55	7.6	14.5	22.0
		Hired at Age 45	
55	18.3	14.6	20.5
B. At 5% Higher Inflation and Discount Rates			
		Hired at Age 25	
35	11.2%	6.3%	10.0%
40	12.9	7.4	11.8
45	14.6	8.9	14.6
50	14.4	10.9	17.4
55	5.3	9.7	8.4
		Hired at Age 35	
45	12.6	7.8	11.7
50	14.2	9.7	14.7
55	6.5	9.8	15.6
		Hired at Age 45	
55	12.6	9.3	13.6

Table 15
Ratios of Pension Wealth to Earnings Wealth and Ratios of Differences in Pension Wealth to Wages for Alternative Ages of Hire for Defined Benefit and Combination Plans

Retire at	Hired at 25	Hired at 30	25-30 Difference	Hired at 35	30-35 Difference	Hired at 40	35-40 Difference
				All Plans			
50	7.4%	7.3%	8.9%	6.9%	8.7%	5.7%	8.8%
55	12.1	11.2	15.7	10.7	12.5	9.9	13.3
60	12.6	13.1	10.0	13.0	12.5	12.9	13.0
65	12.2	12.8	7.9	13.3	9.4	13.7	10.9
70	8.9	9.3	5.5	9.7	6.8	9.9	7.8
				Plans with Service Requirements for Normal Retirement			
50	8.3%	8.2%	10.5%	7.5%	10.6%	6.6%	11.2%
55	14.9	13.0	22.5	12.1	15.6	11.2	15.4
60	14.9	15.4	11.6	15.2	15.2	15.0	15.1
65	13.6	14.2	9.0	14.7	10.5	15.3	11.6
70	10.0	10.4	6.1	10.8	7.5	11.2	8.2

Table 16
Disaggregated Pension Wealth and Earnings Wealth, Using Covered Workers Actual Date of Hire

	Union	Nonunion	Male	Female	Black	Nonblack
			Retirement at Normal Retirement Age			
DB & Combination Plans						
Mean Pension Wealth	92	164	137	131	92	139
Mean Earnings Wealth	746	1063	996	817	695	957
Pension-Earnings Ratio	13.1	15.1	13.7	15.4	13.1	14.4
All Plans						
Pension-Earnings Ratio	13.0%	14.1%	13.3%	14.3%	12.6%	13.8%
			Retirement at Age 65			
DB & Combination Plans						
Mean Pension Wealth	90	165	135	133	99	138
Mean Earnings Wealth	859	1183	1128	908	795	1076
Pension-Earnings Ratio	11.0%	13.5%	11.8%	13.7%	12.0%	12.5%
All Plans						
Pension-Earnings Ratio	10.9	12.7	11.6	12.8	11.5	12.1

Regression Results with Ratio of Pension Wealth to Earnings Wealth as Dependent Variable for Individuals Hired at Age 25

	Mean of Explanatory Variable[a]	Age of Retirement 55	60	65
Mean Ratio		0.122	0.127	0.123
Regression Variables:				
Constant		0.084	0.095	0.101
		(3.97)	(5.21)	(6.37)
Union	0.410	-0.003	-0.008	-0.010
	(0.30)	(1.10)	(1.48)	
Female	0.350	0.005	0.009	0.016
	(0.61)	(1.25)	(2.48)	
Black	0.089	-0.001	-0.003	-0.001
	(0.08)	(0.28)	(0.06)	
Manufacturing	0.474	-0.028	-0.030	-0.035
	(0.89)	(1.10)	(1.45)	
Large Firm	0.932	0.025	0.020	0.008
	(1.37)	(1.31)	(0.58)	
Manufacturing * Large Firm	0.456	0.023	0.024	0.032
		(0.71)	(0.86)	(1.29)
White Collar Occupation	0.374	0.017	0.014	0.007
		(1.63)	(1.55)	(0.88)
Management	0.163	0.019	0.018	0.014
		(1.39)	(1.52)	(1.41)
<12 Years Education	0.149	-0.010	-0.007	-0.004
		(0.87)	(0.07)	(0.49)
13-15 Years Education	0.229	0.008	0.010	0.011
		(0.83)	(1.17)	(1.42)
16+ Years Education	0.221	0.014	0.021	0.028
		(1.24)	(2.15)	(3.32)
Multiemployer Plan	0.219	0.012	0.010	0.010
		(1.26)	(1.16)	(1.45)
R^2		0.051	0.082	0.104
Number of Observations		529	529	529

ll variables are dummy variables. Absolute t-statistics in parentheses

Table 18
Impact of Union Status, Gender and Race on the Ratio of the Increment in Pension Wealth to the Wage for Workers Hired at Age 25 in Defined Benefit and Combination Plans

Age	ΔP/ΔE	Coefficients of Binary Variables for:[a] Union	Female	Black
55	0.125	-0.052 (3.23)	0.036 (2.27)	-0.035 (1.44)
56	0.113	-0.050 (3.39)	0.047 (3.27)	-0.036 (1.63)
57	0.113	-0.045 (2.35)	0.049 (2.59)	-0.049 (1.68)
58	0.091	-0.049 (3.19)	0.059 (3.94)	-0.033 (1.44)
59	0.131	0.000 (0.01)	0.052 (1.31)	-0.003 (0.05)
60	0.048	-0.063 (3.55)	0.051 (2.93)	0.009 (0.33)
61	0.101	0.050 (0.90)	0.037 (.067)	-0.090 (1.07)
62	-0.013	-0.063 (3.93)	0.099 (6.27)	0.027 (1.12)
63	-0.030	-0.058 (3.48)	0.100 (6.06)	0.026 (1.03)
64	0.032	-0.032 (0.69)	0.180 (3.92)	-0.042 (0.59)
65	-0.245	-0.027 (1.35)	0.066 (3.32)	0.022 (0.70)
66	-0.246	-0.034 (1.79)	0.067 (3.54)	0.021 (0.74)
67	-0.249	-0.044 (2.22)	0.066 (3.59)	0.012 (0.42)
68	-0.258	-0.049 (2.59)	0.057 (3.05)	0.014 (0.49)
69	-0.261	-0.055 (3.00)	0.057 (3.14)	0.010 (0.37)
70	-0.284	-0.048 (2.50)	0.056 (2.95)	0.025 (0.85)

[a]Absolute t-statistics in parentheses.

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Appendix

Using The Survey of Consumer Finances To Calculate Pension Values

The 1983 Survey of Consumer Finances is a two-part survey that is particularly suited for questions related to pensions. The first part is a national random sample of 4262 households. For each household, the respondent and the spouse were asked a variety of questions, including questions pertaining to current labor force behavior and to pension coverage. Households that indicated pension coverage were asked to name the pension provider, and the second part of the survey contains information from documents gathered from these pension providers. The pension provider records indicate the specific formulas used in calculating normal retirement benefits, early retirement benefits, and deferred vested benefits, the manner in which such variables as service years, average salary amounts, and Social Security offsets are calculated, and detailed descriptions of the requirements that the individual must have met in order to be eligible for the various classes of benefits.

The estimates in the paper are based on individuals in the Survey of Consumer Finances who were employed at the time of the survey and who indicated that they either were eligible for a pension in their current job or would be eligible if they remained in the job, and for whom information on the pension is available in the pension provider part of the survey. The sample is further restricted to require that the individuals be private sector employees who usually worked more than 30 hours per week and who were not self-employed. The sample excludes the special high income group of the survey.

Pension benefit amounts are calculated from sections specifying normal retirement benefits, early retirement benefits, and deferred vested benefits in defined benefit plans, and from the section specifying benefits in defined contribution plans. If the plan had both defined benefit and defined contribution benefits, both kinds of benefits are calculated. Further, if the

individual was covered by more than one plan in the current job, the results refer to the sum of all the benefits for which the individual might be eligible. For plans that specified required contributions, the amount of these contributions is subtracted from wages to give the net wage figures in the paper. The value of death and disability benefits is omitted from the calculations. Also omitted are benefits arising from voluntary contributions and from profit sharing contributions. There is almost no basis on which to judge what the amounts of benefits from profit sharing contributions might be.

The calculations begin with a wage equation estimated for individuals in the SCF with pensions. The dependent variable is log wage, and explanatory variables include experience, experience squared, tenure, tenure squared, education, education squared, a tenure-education interaction, an experience-education interaction, tenure and experience interacted with union status, dummy variables for marital status, health status, union membership, industry categories (8), geographical regions (4), and SMSA residence. The coefficients from the wage equation are then used to construct a wage profile through each individual's observed 1983 wage level. These are wages in 1983 dollars, and current dollar wages are obtained by assuming general wage growth of 5.44% per year, which is the compound rate by which wages grew in the 30 year period prior to 1983.

Using the wage profile so obtained, the pension provider information is used to calculate the benefits that would be available if the individual were to retire at alternate ages. At each age, amounts are calculated for any normal retirement, early retirement, or deferred vested benefits for which the individual may be eligible, and the actual benefit is presumed to be the largest such amount. If a part of the plan (usually the deferred vested benefit section) allows the individual to choose the date he or she begins collecting benefits, the date which maximizes the present value of the benefits is used. In these calculations, it is assumed that any nominal quantities in the pension plans grow at the same rate as general wage growth. Also, it is assumed that once an individual begins to collect benefits, the

benefits are increased by 38% of the increase in the price level, conforming to results presented in Allen, Clark, and Sumner (1986). The price inflation rate is taken to be 4.64%, the compound inflation rate of the CPI in the 30 year period ending in 1983, and no distinction is made between the post retirement adjustments for union and nonunion workers. Using survival tables reflecting gender and race (but not pension status), all benefits are then multiplied by the conditional probability of living until the age in question, given survival until the retirement date, and discounted back to the year of retirement using a discount factor equal to the rate of general wage growth. Finally, the benefits are summed to yield a value for pension wealth as of the retirement year which is converted back to 1983 dollars using the same discount factor.

Two sets of calculations use hypothetical hire dates and wages. For the case using hypothetical hire dates, the alternative ages of hire are taken to be 25, 35, and 45. In this case, the plan features are assumed to be those in place in 1983, and the question is how the incentives provided by the plans would be different if the individuals in the sample had been hired at different ages. As before, nominal amounts in the plans are presumed to increase with general wage growth. The operational meaning of "plan features in place in 1983" is that variables which are defined over limited calendar periods are assumed to be defined over all periods if the limited period includes 1983 and to be zero if the limited period does not include 1983. For example, many plans contain expressions similar to 1.5% * ASY1 * FAP1 + 1.75% * ASY2 * FAP2, where ASY1 and FAP1 are service years and average salary before, say, 1975, and ASY2 and FAP2 are the corresponding quantities after 1975. In this case, such a formula would be treated as 1.75% * ASY * FAP, where ASY and FAP are applicable over all years, since ASY2 and FAP2 encompass 1983. Other variables which involve restrictions on dates of applicability are treated similarly.

For the case involving hypothetical wages, the calculations are much the same as in the base case, except that gross wages (i.e., before mandatory

contributions are deducted) in every year are multiplied by the ratio of some set amount ($10,000, $25,000, or $50,000) to the gross wage observed in 1983, adjusted to the wage at zero tenure and zero experience. This has the effect of shifting the entire wage profile proportionately up or down so that it begins (in real terms) at the set amount. Dollar amounts in the pension plans are not multiplied by the same factor of proportionality. However, the dollar amounts are still assumed to increase with increases in the general wage level, the same as is done in the other cases.

The benefit calculations rely a large number of individual pieces of information from each record in the data set, but unfortunately in many records at least one piece of information is either missing or is suspicious. In some of these records, either there seems to be an obvious correction to a miscoded variable, or possible alternative assumptions about a miscoded variable appear to have only minor effects on the calculations. In other records, however, the missing or suspicious information is critical enough to the calculations that the observation is deleted.

In this latter category, most of the lost observations occur for one of the following three reasons: (i) 14.7% of the potential observations lack sufficient information to construct the gross wage in 1983. This creates problems because if an incorrect imputed wage is used, either the level of the present value of benefits (in salary-based plans) or the ratio of the present value of benefits to wages (in pattern plans) is likely to be seriously misstated. (ii) Another 8.8% of the potential observations involve plans for which either early retirement or deferred vested benefits involve a reduction factor that is unspecified in the data set. Conversations with Richard Curtin at the Survey Research Center indicate that for the most part, these reduction factors are unspecified in the documentation sent by the firms to the Survey Research Center. There are such a variety reduction factors in observed plans, ranging from approximately actuarially fair to quite actuarially unfair, and the incentives provided by the plans are so sensitive to the actuarial fairness of the reduction factors, that we feel it best to refrain

from any attempt to impute these variables. (iii) 5.7% of the potential observations are deleted even with no missing or suspicious information because they yield a calculated present value of zero for the pension if the individual retires at age 65. For the most part, these plans involve either variables (e.g., service years or final average pay) or eligibility requirements restricted to calendar time periods such that the individual could never collect benefits under the plan. In a relatively small number of cases, the zero benefits arise because of very large Social Security offset provisions in the plan.

Among the problems which do not result in the deletion of observations, the major one is that about 9% of the plans involve mandatory contributions whose level is unspecified. Fortunately, the level of such contributions has only a relatively minor effect on incentives provided by the plans, and since these contributions range from fairly token amounts to several percentage points of salary, rendering imputations arbitrary, they are omitted from the calculations (i.e., not subtracted from gross wages). About 3% of the plans involve unspecified firm contributions other than profit sharing; these are treated in the same manner as are profit sharing amounts and are omitted. About 1% of the plans involve inconsistencies in the specification of variables and/or equations as monthly vs. annual amounts. For example, a benefit amount specified as monthly might be given by the equation 1.5% * FAP1 * ASY1, where all other equations and variables in the plan are specified as monthly but where FAP1 is specified as an average annual amount, thus producing unreasonably large benefit amounts. Case by case examination of these inconsistencies suggest coding errors in almost all (but not all) cases, and these are corrected where necessary. Similarly, another 5% of the plans produced benefit streams that seem unreasonable in one way or another, and for which the cause can be tracked down to one of a wide variety of apparent miscodings whose corrections appear relatively straightforward.