Pension integration and retirement benefits

Pension integration generally increases benefits modestly for workers with less tenure and decreases benefits substantially for workers with more tenure; offset integrated plans have significantly higher replacement rates than excess-rate integrated plans

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The issue of retiree income is important in a time of proposed Social Security reform. In 1996, for example, the shares of aggregate income for those aged 65 or older were, on average, 40.3 percent from Social Security, 18.5 percent from employer pensions, 20 percent from employment, and 21.1 percent from assets and other forms of income.[1] Integration of pension income with Social Security income likely reduces benefits for many retirees, making research on income from integrated pensions critical.

Previous research creates hypothetical earnings histories to simulate the effect of integration on actual plans. In one such simulation, Avy Graham finds that integration decreases replacement rates for low earners and increases them for middle and high earners, compared with those with nonintegrated pensions.[2] By contrast, Keith Bender reports that recent survey data show only a slight correlation between higher replacement rates and higher income for integrated plans.[3] The current article presents new evidence, using a combination of survey data on workers and on their actual pension plans.

Background

Some basics on pension integration. An employer pension plan is *integrated* when it explicitly takes into account Social Security benefits in determining the pension benefit.[4] Because both defined-benefit and defined-contribution plans can be integrated, integration affects a significant number of workers. Data on the rate of integration in private-sector defined-benefit plans are found in the Employee Benefits Survey conducted by the Bureau of Labor Statistics. In 1995, 51 percent of full-time private-sector workers in medium-sized and large establishments who participated in a defined-benefit pension plan were in an integrated plan. However, because roughly half of the workforce was covered by a defined-benefit plan that year, the rate of defined-benefit pension integration among all full-time private-sector workers in medium-sized and large establishments was 26.5 percent. No data have been published on integrated defined-contribution plans, but Bender, using data from the Health and Retirement Study (HRS), shows that approximately 8 percent of workers participating in such plans have an integrated pension.[5] Overall, integration rates in the study are approximately 32 percent for the subsample covered by a pension and 14 percent for the working subsample. Finally, pension integration is rare among government employees. The Federal retirement system is not integrated with Social Security, and, as Ann C. Foster reports, less than 10 percent of all State and local government employees have plans that are integrated with Social Security.[6]

Integration in defined-benefit plans can take place in two ways. Before the Tax Reform Act of 1986, the *offset method* reduced the employer pension by a portion (usually 50 percent) of the retiree's Social Security retirement benefit. For example, suppose that, in the absence of the offset, a new retiree would receive an annual pension benefit of $10,000 and an annual Social Se-

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curity benefit of $8,000. If the pension was integrated by the offset method, then the annual benefit would be reduced by half of the Social Security benefit, to $6,000. Therefore, the pension income of the retiree is $4,000 lower under an integrated plan than it would be in the absence of the plan.

However, the new provisions under the 1986 act modified the offset to be *at most* 50 percent of the employer pension benefit. This was done to ensure that the employer pension could not be reduced to zero, as was possible under the previous integration provisions when the Social Security benefit was more than twice the pension benefit. The new provisions did not entail that offset pensions would automatically be more generous; indeed, in the example of the previous paragraph, under the 1986 regulations half of the pension ($5,000) would be offset, so that the retiree would receive only $5,000 from the pension, as opposed to the earlier figure of $6,000.[7]

Defined-benefit plans can also be integrated through the *excess-rate*, or *step-rate*, *method*, which is characterized by a lower benefit accrual rate for earnings below the integration earnings level (often the Social Security taxable maximum) than for earnings above the integration level. An example of this type of plan is one with an accrual rate of 1 percent of the participant's final salary per year of service for earnings under the taxable maximum ($76,200 in 2000) and 1.5 percent for earnings above the taxable maximum. In this plan, a worker with 30 years of service who earned $100,000 in his or her final year of work and who retired with an excess-rate pension would receive an employer pension benefit of $(0.01 \times 30 \times \$76{,}200) + 0.015 \times 30 \times (\$100{,}000 - \$76{,}200) = \$33{,}570$.

Defined-contribution plans can also be integrated, usually in a method similar to the excess-rate method, if there are different employer contribution rates that depend on the worker's earnings level.

Pension integration and replacement rates.[8] The effect of integration on replacement rates depends on a number of factors. Because of the progressive nature of the Social Security benefit formula, highly paid workers with offset plans will have higher replacement rates compared with the low paid with offset pensions, assuming equal replacement rates before the offset. When accrual rates are the same across integrated and nonintegrated pensions, workers with offset plans will have lower replacement rates than workers who receive pension benefits from nonintegrated plans. For example, consider two workers, each of whom earned $40,000 before retirement and who differ only in that one has a nonintegrated pension, while the other's pension is integrated by the offset method. Using the offset example delineated above, one calculates easily that the nonintegrated pension replaces 25 percent of final-year earnings ($10,000 in pension benefits, divided by $40,000 in final-year earnings), while the integrated pension replaces only 15 percent ($6,000 in pension benefits, divided by $40,000 in final-year earnings).

This analysis is valid, however, only if the accrual rates are equal. Using the 1991 Employee Benefits Survey (EBS), Graham finds that, among defined-benefit plans providing a flat percentage of the earnings benefit, the average benefit rate for offset plans is 1.66 percent of the final earnings per year of service, a figure that contrasts with an average benefit rate of 1.42 percent for defined-benefit plans without an offset formula.[9] Graham provides a hypothetical example in which even this higher accrual rate does not fully compensate for the offset for a given income level. At higher levels of income, there is a lower relative offset, given the progressive nature of Social Security benefits. Therefore, when the relative offset decreases with the higher income, it may be more than compensated for by the higher accrual rate.[10]

The influence of integration using excess-rate methods also is ambiguous.[11] With integrated excess-rate plans, more highly paid workers (for example, those with earnings above the taxable maximum) receive benefits that replace a higher proportion of their preretirement earnings. However, when replacement rates are compared across nonintegrated and integrated plans, the relationship is not as clear, because the size of the replacement rates depends on whether the accrual rates for integrated or for nonintegrated plans are higher, other things being equal. For example, if the average accrual rate for earnings above the integration level in integrated plans is equal to or below the accrual rate for the average nonintegrated plan, then the replacement rates will tend to be lower for workers with integrated plans. In the previous example of an excess-rate plan, if the nonintegrated accrual rate were 1.5 percent, a worker earning $100,000 would replace 45 percent of that income for 30 years of service. A worker participating in the earlier example of an integrated plan would replace 34 percent ($33,570 in pension benefits, divided by $100,000 in final earnings) of his or her earned income.

If pensions are used as an incentive to retain highly skilled (and, likely, highly paid) workers, the accrual rate for earnings below the integration level may be set at the average accrual rate of average nonintegrated pensions. High earners would then have a greater incentive to stay with the firm under an excess-rate plan. Under such circumstances, a nonintegrated pension with an accrual rate of 1 percent, based on final earnings of $100,000, would generate a replacement rate of 30 percent, compared with 34 percent for the integrated pension plan.

Of course, these are extreme examples, and the actual accrual rates in excess-rate plans are more likely to be somewhere between these extremes. Therefore, replacement rates for low-paid workers may be lower for those with an integrated excess-rate pension plan compared with those with a nonintegrated plan, while the high-paid workers in an excess-rate plan may have higher or lower replacement rates than those with nonintegrated pensions.

Finally, the effects of tenure on integrated-plan benefits depend upon the method of integration. In excess-rate plans, whose benefit levels are based on tenure, higher levels of tenure should cause the differences between integrated and nonintegrated accrual rates to become more pronounced. In offset plans, the effect of Social Security benefits complicates the relationship between pension benefits and tenure.

Previous research. Previous research on the effect of pension integration on replacement rates has focused primarily on calculating replacement rates of hypothetical workers participating in typical integrated and nonintegrated plans, as was done above. Several studies[12] have made these calculations, but Graham analyzes the issue most extensively, using the average formulas from actual defined-benefit plans from the 1991 EBS to calculate replacement rates by number of years in the plan and earnings level. Her main result is that, holding years of participation constant, replacement rates for nonintegrated plans tend to decrease with earnings, while replacement rates for integrated plans generally increase with earnings. Furthermore, integrated pensions are estimated to have higher replacement rates than those of nonintegrated pension plans at high earnings levels and lower rates at low earnings levels.[13]

While Graham's simulation is based on actual pension plan data, it does not take into account the heterogeneity of the workers who participate in these plans. Previous research shows that personal characteristics differ significantly between workers with and without integrated plans; the implication is that research which ignores this heterogeneity may lack an important factor in comparing replacement rates.[14] In addition, Graham examines integrated plans as a group, compared with nonintegrated plans. As mentioned earlier, there are likely to be differences in the replacement ratios of offset and excess-rate plans. The analysis that follows disaggregates the two types of plans and accounts for the heterogeneity of workers to see whether replacement rates depend on the type of integration.

Data Issues

The data set used in this article is the 1992 HRS. The sample is restricted to those aged 51 to 61 years in 1992, who are covered by a pension from a current job, or for those not currently working, the most recent job, and who have data entries in the Pension Provider Survey (PPS), the detailed pension survey that is part of the HRS. The PPS contains information on workers' sociodemographic characteristics, occupational and industrial affiliation, union membership, and pension characteristics.

Estimated values of replacement rates, based on the projected earnings at age 65, and annual pension benefits were added to the data. Pension benefits are simulated using the HRS Pension Calculator, based on the characteristics of the actual pension plans that cover HRS respondents.[15] The calculations utilize survey-supplied demographic and job-related information (such as age, gender, hiring date, and earnings level), as well as assumptions regarding parameters such as earnings growth, inflation, and other factors. The values of the parameters are based on the intermediate assumptions of actuarial projections from the 1992 *Social Security Trustee's Report.* A further assumption is that, regardless of when workers plan to retire or actually have retired, all workers retire at age 65. Besides the parallel with Graham's analysis, which also assumes a retirement age of 65, that age is when full, unreduced benefits are available from Social Security and most private pensions (although many pensions give full benefits before age 65). With the assumption of a common retirement age, no complicating effects arise in comparing retirement benefits across workers of varying retirement ages. Pension benefits and Social Security benefits (needed for offset plan benefit calculations) are computed using current earnings and assumptions on earnings growth to estimate both retrospective and future earnings, the latter because the pension benefit calculations use earnings over a worker's tenure with the firm, whereas the Social Security benefit calculations use whole-career earnings. With these data, the Pension Calculator simulates earnings histories of workers to the age of 65, meaning that tenure and earnings are projected forward until that age. Then the pension plan characteristics are used to calculate annual benefits and replacement rates as if those workers retired at age 65.[16]

An important issue is how to treat the case of workers who are covered by more than one pension on their current or (if they are not currently working) most recent job.[17] Each such individual was replicated for each plan in which he or she participated, although the plan-specific pension benefits remained with the plan (meaning that estimated pension benefits differ across plans). The result is that the unit of observation for the final data sample is based on a worker-pension, rather than just a worker, observation.[18] Sample weights were adjusted to maintain the representative nature of the data.[19] All monetary values are adjusted to 1992 dollars.

Because the rate of integration is very low for defined-contribution plans, there are not enough observations to compare integrated with nonintegrated defined-contribution plans. Hence, the analysis is restricted to defined-benefit plans. (Workers with both defined-benefit and defined-contribution plans have information on the latter dropped.) This restriction allows a more direct comparison with Graham's analysis, which also examines defined-benefit plans only. When all of the restrictions on the data are taken into account, there are 2,197 worker-pension observations, 1,375 of which are covered by a nonintegrated pension and 822 by an integrated pension.[20] Of those with integrated pensions, 502 have excess-rate provisions, while 387 have offset provisions.[21]

Results

Graham's analysis is based on the 1991 EBS, which collected information on pension plans from medium-sized and large private-sector establishments. Until recently, the EBS was the only data source on integrated plans, although it has virtually no information on the workers covered by these plans. The advantage of the person-level HRS is that one can analyze how pension integration affects the retirement benefits of workers with a variety of demographic and workplace-related characteristics and differing job histories.

Integration, retirement benefits, and worker characteristics. Table 1 examines the data on retirement benefits generated by the HRS Pension Calculator, by integration status and selected worker characteristics.[22] Overall, the average replacement rate is 38.7 percent for nonintegrated plans and 26.9 percent for integrated plans. Except for those with associate's degrees and those in manufacturing, every characteristic of workers shows that, on average, the nonintegrated replacement rate is higher than the integrated replacement rate. While a few of the differences are small (for example, for mechanics and operators among occupations), clearly, replacement rates are lower for integrated plans, on average.

The table also shows estimated replacement rates by method of integration. Overall, the replacement rates for offset plans (30.3 percent) are higher than those for excess-rate plans (24.0 percent). This is also the case for the majority of worker characteristics. The only instances in which excess-rate replacement rates are higher are in large firms (with 100 or more workers) and for sales occupations. Note that public-sector[23] workers with offset plans and workers in natural resources and manufacturing industries, regardless of the type of integration their plans possess, have a higher average replacement rate than workers

Table 1. Average estimated replacement rates and annual benefits at age 65, by integration status and demographic characteristic

Characteristic	Replacement rate (in percent)				Annual Benefits			
	Nonintegrated	Integrated	Excess	Offset	Nonintegrated	Integrated	Excess	Offset
Overall	38.7 (1,375)	26.9 (822)	24.0 (502)	30.3 (387)	$20,578	$15,088	$13,330	$17,624
Women	40.0 (616)	25.9 (365)	22.5 (224)	29.8 (161)	17,906	9,970	8,410	11,648
Men	37.7 (759)	27.7 (457)	25.2 (278)	30.7 (226)	22,592	19,044	17,108	21,695
White	38.5 (984)	26.4 (635)	24.2 (402)	29.4 (288)	21,071	15,140	13,672	17,518
Black	41.5 (291)	29.8 (134)	23.8 (75)	36.6 (64)	18,178	13,189	9,743	17,171
Hispanic	33.1 (78)	26.2 (41)	20.6 (18)	28.0 (29)	14,300	12,290	10,948	13,549
Other	44.0 (22)	33.8 (12)	19.9 (7)	43.0 (6)	29,315	24,255	14,299	30,018
No high school	34.5 (415)	25.7 (289)	22.8 (167)	29.0 (144)	16,234	11,766	10,676	13,578
High school	36.4 (481)	24.6 (331)	23.7 (211)	26.1 (148)	14,983	11,555	10,427	13,475
Associate's degree	38.9 (49)	39.6 (31)	26.3 (13)	45.5 (20)	19,784	22,259	15,569	25,894
Bachelor's degree	44.5 (194)	28.6 (113)	25.9 (76)	32.3 (49)	26,990	22,342	21,365	24,748
Graduate degree	44.4 (236)	33.1 (58)	26.2 (35)	40.3 (26)	32,196	28,392	23,147	33,458
Union covered	37.6 (775)	30.5 (281)	25.5 (147)	35.0 (150)	19,595	15,094	12,027	18,294
Not covered	40.1 (600)	24.8 (541)	23.3 (355)	27.1 (237)	21,838	15,085	13,915	17,155
Firm size < 100	41.6 (45)	22.8 (13)	22.7 (12)	— (1)	19,883	10,685	10,893	—
Firm size 100–499	38.7 (159)	30.4 (47)	38.6 (33)	34.1 (18)	19,610	15,038	14,054	17,018
Firm size > 499	39.7 (989)	27.4 (676)	35.6 (392)	30.2 (346)	22,177	15,729	14,145	17,676
Industry:								
Natural resources	18.7 (14)	22.9 (16)	23.4 (10)	24.5 (9)	9,992	16,797	18,099	20,228
Manufacturing	22.4 (196)	25.7 (278)	24.4 (164)	26.8 (152)	10,107	15,224	13,420	17,042
Transport	31.9 (87)	27.3 (83)	25.7 (49)	29.6 (40)	16,709	18,181	14,987	22,167
Sales	22.2 (27)	16.6 (72)	17.2 (34)	17.3 (42)	8,664	6,744	7,441	7,613
Service	31.0 (22)	21.3 (104)	21.3 (77)	21.2 (38)	12,364	14,271	15,722	11,461
Professional	34.3 (197)	23.6 (88)	22.2 (66)	28.5 (23)	17,616	11,024	10,937	12,656
Public sector	44.7 (826)	36.7 (174)	28.0 (99)	45.4 (78)	24,455	18,830	13,855	23,930
Occupation:								
Manager	43.3 (215)	29.8 (141)	26.2 (91)	34.9 (66)	30,136	24,090	22,255	26,817
Professional	45.4 (373)	29.1 (134)	25.2 (89)	34.7 (58)	28,735	19,173	15,455	24,897
Sales	26.8 (25)	19.7 (39)	22.0 (22)	17.3 (19)	10,229	8,839	10,998	8,274
Clerical	42.6 (253)	27.1 (188)	23.7 (117)	30.5 (84)	16,767	10,708	9,038	12,327
Service	33.2 (175)	26.3 (68)	23.8 (38)	29.3 (31)	11,884	9,521	8,174	11,344
Mechanics and repair	27.9 (79)	27.2 (50)	24.5 (28)	30.1 (23)	12,592	18,243	12,231	24,363
Construction	29.2 (39)	27.0 (17)	27.1 (14)	28.0 (5)	14,422	15,636	15,948	16,032
Precision and production.	36.7 (37)	25.6 (50)	21.0 (27)	29.2 (30)	12,245	11,690	10,066	13,201
Operators, including machine, transport, and handlers	25.8 (176)	22.8 (134)	20.7 (76)	25.2 (70)	9,743	9,680	8,503	11,423

NOTE: Dash indicates not enough observations to calculate the average replacement rate or annual benefit. Results are weighted by revised sample weights. Annual benefits are adjusted for 1992 prices. Numbers in parentheses are the unweighted numbers of worker-pension observations. Missing observations: 268 for firm size, 13 for industry, and 4 for occupation.

Table 2. Selected results from replacement rate regressions, by type of pension plan

Variable	Not integrated	Integrated	Excess rate	Offset
Number of observations	1,375	822	502	387
Pay at age 65, in dollars	[1].00029 (7.27)	[1].00033 (7.39)	[1].00023 (4.81)	[1].00061 (6.75)
Pay squared	[1]-8.2×10^{-10} (–5.85)	[1]-1.0×10^{-9} (–5.84)	[1]-7.1×10^{-10} (–4.29)	[1]-3.3×10^{-9} (–5.35)
Tenure in years at age 65	[2]2.0529 (7.79)	[1]1.0185 (3.77)	[1].9867 (3.64)	[2]1.0666 (2.31)
Tenure squared	[1]–.0148 (–3.41)	–.0057 (–1.30)	–.0055 (–1.24)	–.0063 (–.84)
Adjusted R^2	.468	.379	.361	.441

[1] $p < .01$.
[2] $p < .05$.

NOTE: The dependent variable is the estimated replacement rate in percentage points, assuming retirement at age 65. Student's *t*-statistics are in parentheses. The regressions also included a constant term and variables controlling for gender, race or ethnicity, education level, union coverage, firm size, one-digit Standard Industrial Classification, and one-digit Standard Occupational Classification. Full results are available from the author. Monetary values are based on 1992 prices.

with nonintegrated plans have in their respective industries.

The effect of integration on annual benefits is shown in the table as well. Again, nonintegrated plans pay a higher average annual benefit ($20,578, compared with $15,088 for integrated plans). However, for several categories (those with an associate's degree; workers in the natural resources, manufacturing, transport, and service industries; and those in mechanics and construction occupations), the average benefits are higher for integrated plans. Furthermore, upon breaking down integrated plans into excess-rate and offset plans, it becomes clear that offset plans are more generous, on average, by more than $4,000 ($17,624, as against $13,330) and that in several instances (workers in the "other" race category; those with associate's and graduate degrees; workers in the natural resources, manufacturing, and transport industries; and those in mechanics, construction, precision production, and operator occupations), the average offset plan benefit is larger than the nonintegrated plan benefit. In two instances (workers in the service industry and those in sales occupations), excess-rate plans are more generous than offset plans and nonintegrated plans, on average. Clearly, the empirical relationship between integration and benefits, while generally inverse, is more complex among actual workers and different types of plans than previous research indicates.

Regression results. While the results displayed in table 1 show differences in retirement benefits from different types of plans, it could be that these averages are influenced by the different characteristics of those with integrated and nonintegrated pensions. To control for these characteristics, a series of multivariate regressions is estimated. Separate weighted regressions are run for the samples of workers with nonintegrated and integrated pensions wherein the dependent variable is the replacement rate or annual benefits. The key independent variables are earnings and tenure at age 65. As reported in Graham, the relationship between replacement rates, on the one hand, and earnings and tenure, on the other, is nonlinear.[24] To account for these nonlinearities, squared terms for the earnings and tenure variables are included in the regressions. Other variables that are controlled for, but not reported in the tables, are gender, race or ethnicity, education, union status, firm size, and industrial and occupational affiliation.[25] These variables are listed in table 1.

Table 2 contains selected results from the replacement rate regressions. The relationships between the replacement rates of nonintegrated pensions, on the one hand, and pay and tenure, on the other, are significant, positive, and nonlinear (as indicated by the significance of the negative squared terms). Table 3 shows the effects of changes in pay and of tenure at age 65 on replacement rates. Assuming changes from the average levels of pay and tenure (given in the last two rows of the table), the effect of a $1,000 increase in pay is to increase the replacement rate of nonintegrated plans by 0.24 percentage point.[26]

The positive relationships reported here may seem somewhat counterintuitive, because defined-benefit plans are generally characterized by accrual rates which generate replace-

Table 3. Effects of changes in pay and tenure at age 65 on pension benefits, by type of pension plan

Regression	Not integrated	Integrated	Excess rate	Offset
Replacement rate regression:				
Pay (thousands)	0.24	0.26	0.18	0.37
Tenure	1.14	.67	.65	.67
Annual benefit regression:				
Pay (thousands)	$750	$532	$458	$654
Tenure	$664	$358	$341	$355
Average pay at age 65	$33,478.52	$34,574.80	$34,343.46	$35,896.03
Average tenure at age 65	30.99	30.90	30.41	31.73

NOTE: Effects are based on the coefficients given in tables 2 and 4. Replacement rate changes are in percentage points. Monetary values are in 1992 prices.

ment rates that are relatively invariant to earnings levels. A positive relationship may be due to relatively more generous pensions being correlated with relatively high-paying industries or occupations. A negative relationship could be generated by benefits that are based not on accrual rates (percent of earnings multiplied by tenure), but on a flat dollar figure multiplied by tenure.[27]

The effect of tenure on replacement rates is much larger than the effect of earnings. Table 3 indicates that an increase in tenure of 1 year results in an increase in the replacement rate of 1.14 percentage points. Graham also finds a strong positive relationship between tenure and replacement rates.

In addition to displaying the regression results for nonintegrated plans, table 2 shows the results for integrated plans. For all integrated plans, pay and its square are significant, as they are for the nonintegrated plans. However, while tenure at age 65 is significant, its square is not, indicating that the relationship between tenure and replacement rates is likely a linear one for integrated plans. Examining the effects of changes in pay and tenure for integrated plans in table 3 indicates that a $1,000 increase in pay increases the integrated replacement rate by 0.26 percentage point, somewhat more than for nonintegrated replacement rates. This is caused by the relatively large effect on offset plans (an increase of 0.37 percentage point). The tenure effect, conversely, is smaller than for nonintegrated plans, with a year's increase in tenure resulting in an increase of 0.67 percentage point in the replacement rate for all integrated pensions.

Table 4 presents selected results from the estimated annual benefits regressions. Again, pay is significant in all types of pensions. However, the tenure effects are weaker, with none of the squared terms significant, and in the offset plan sample, the tenure term is not significant. Table 3 shows the effects of changes in pay and tenure on annual benefits. In contrast to its effect on replacement rates, the effect of a $1,000 increase in pay on benefits is larger for nonintegrated plans ($750) than for integrated plans ($532), although offset plans are close ($654). This pattern continues with the effect of changes in tenure on annual benefits: an increase in tenure by 1 year increases annual benefits for nonintegrated plans by $664, while raising benefits for integrated plans by $358 ($341 for excess-rate plans and $355 for offset plans).[28]

Simulations of replacement rate profiles. To see how the earnings and tenure coefficients affect replacement rates, simulations using the results from the regressions were calculated for a variety of tenure and earnings categories in a manner similar to Graham's calculations.[29] To calculate the replacement rates, a base replacement rate was computed for each type of plan, using the weighted averages of all the variables (except pay and tenure) and the estimated coefficients from the regressions. Then the projected pay and tenure categories were included (along with their coefficients) to generate replacement rates that vary by pay, tenure, and type of pension. Table 5 shows the results of these simulations for workers covered by nonintegrated plans and those covered by integrated plans. Integrated pensions have higher replacement rates only at the lowest tenure level (10 years). In contrast, Graham found that, for all tenure levels, integrated pensions had lower replacement rates for the two lower earnings levels and lower rates for the four higher earnings levels. (See table 1 in Graham.) Another way to see the relationships between the different plans' replacement rates is graphically. Chart 1 shows that, generally, nonintegrated replacement rates increase relative to integrated rates as tenure increases. (To keep the graph from being too cluttered, just the 10- and 30-year tenure estimates are plotted.) Once tenure is held constant, the rate of increase with earnings is somewhat faster for integrated plans than for nonintegrated plans. This leads to a slightly increasing difference in replacement rates as earnings rise for low-tenure workers (for whom integrated rates are higher than nonintegrated rates) and a slightly decreasing difference for high-tenure workers (for whom integrated rates are lower).

Table 5 also disaggregates the integrated plans into excess-rate plans and offset plans. Given the differences in the coefficients in the previous tables, one would expect to see some significant differences in the simulated replacement rates. This is exactly what happens. First, for all of the tenure

Table 4. Selected results from annual benefit regressions, by type of pension plan

Variable	Not integrated	Integrated	Excess rate	Offset
Pay at age 65, in dollars	[1]0.837 (32.02)	[1]0.564 (19.54)	[1]0.469 (15.15)	[1]0.862 (14.22)
Pay squared	[1]-1.3×10^{-6} (–14.42)	[1]-4.6×10^{-7} (–4.02)	-1.6×10^{-7} (–1.47)	[1]-2.9×10^{-6} (–6.83)
Tenure in years at age 65	[1]583.29 (3.33)	[1]540.74 (3.05)	[1]601.47 (3.45)	426.68 (1.38)
Tenure squared	1.305 (.45)	–2.960 (–1.03)	–4.281 (–1.50)	–1.132 (–.23)
Adjusted R^2	.692	.696	.779	.666
Number of observations	1,375	822	502	387

[1] $p < .01$.

NOTE: The dependent variable is the estimated annual benefit, assuming retirement at age 65. Student's *t*-statistics are in parentheses. The regressions also included a constant term and variables controlling for gender, race or ethnicity, education level, union coverage, firm size, one-digit Standard Industrial Classification, and one-digit Standard Occupational Classification. Full results are available from the author. Monetary values are based on 1992 prices.

Table 5. Simulated replacement rates, by years of tenure and final-year earnings at age 65

Tenure and integration status	$15,000	$25,000	$35,000	$45,000	$55,000	$65,000
10 years:						
Nonintegrated	5.6	8.1	10.5	12.7	14.8	16.6
Integrated	6.4	9.2	11.9	14.3	16.6	18.6
Excess plan	5.8	7.8	9.7	11.4	13.0	14.5
Offset plan	6.1	10.9	15.0	18.4	21.2	23.3
20 years:						
Nonintegrated	21.7	24.2	26.6	28.8	30.9	32.7
Integrated	14.9	17.7	20.4	22.8	25.0	27.1
Excess plan	14.0	16.0	17.9	19.6	21.3	22.7
Offset plan	14.9	19.7	23.8	27.2	30.0	32.1
30 years:						
Nonintegrated	34.8	37.4	39.7	42.0	44.0	45.9
Integrated	22.2	25.0	27.7	30.1	32.4	34.4
Excess plan	21.1	23.1	25.0	26.8	28.4	29.8
Offset plan	22.5	27.2	31.3	34.7	37.5	39.6
40 years:						
Nonintegrated	45.0	47.6	49.9	52.2	54.2	56.1
Integrated	28.4	31.2	33.9	36.3	38.5	40.6
Excess plan	27.1	29.1	31.0	32.8	34.4	35.8
Offset plan	28.7	33.5	37.6	41.0	43.8	45.9

NOTE: Monetary values are in 1992 prices.

and earnings combinations, offset plans replace higher proportions of earnings than do excess-rate plans. It appears, therefore, that the reduction in benefits effected by offset plans is more than compensated for by their higher accrual rates, compared with the reduction in benefits effected by excess-rate plans. An examination of the integrated and nonintegrated plans in chart 1 reveals that the results are driven primarily by offset plans: offset plan replacement rates are higher and increase more rapidly with earnings than do nonintegrated replacement rates for 10 years of tenure. For higher levels of tenure, the gap between the offset and nonintegrated rates gets smaller as earnings increase. Once more, a graph is helpful in revealing these patterns. Chart 2 shows replacement rates for 10 and 30 years of tenure. (Again, only those estimates are plotted, in order to keep the graph from being too cluttered.) Clearly, the rate of increase in replacement rates as earnings increase for offset plans relative to the rate of increase for other types of plan is sizable.[30]

A final note concerns the inclusion of public-sector workers in the analysis. Unlike Graham, whose data cover private-sector workers only, the HRS also contains information on public-sector workers, making it more representative of the workforce. However, their inclusion poses certain difficulties, given that public-sector pensions are likely to provide higher replacement rates and are much less likely to be integrated, partially because some public-sector workers are not covered by Social Security. Furthermore, the percentage of public-sector workers is quite high in this sample from the HRS, because of the much higher match rate of the detailed pension information to the household survey data for public-sector workers (90 percent) than for private-sector workers (55 percent). Accordingly, while the preceding results include these public-sector workers,[31] results based on the private-sector sample only[32] show that pay becomes much less important in explaining replacement rates and annual benefits of nonintegrated plans, whereas tenure is less important in explaining offset pension retirement benefits. Simulated replacement rates for offset plans are still greater than nonintegrated rates at low levels of tenure, and while replacement rates from offset plans remain greater than those from excess-rate plans, the rate of increase of replacement rates with earnings becomes more similar to that of other types of plans.

THIS ARTICLE HAS SHOWN THAT IT IS IMPORTANT to examine not only actual pension plans, but also the distribution of those plans across workers. Given the heterogeneous characteristics of workers, their replacement rates might differ significantly from rates estimated for hypothetical homogeneous workers (as in Graham). The article has explored this issue by examining the effect of pension integration on pension replacement rates, using data from the Health and Retirement Study. The investigation indicates a somewhat different pattern of results, compared with those of other researchers looking at the relationship.

First, given the very different way that excess-rate and offset integrated plans are structured, they need to be treated differently in the examination of replacement rates of integrated pension plans. Indeed, offset plans are generally estimated to have higher replacement rates than excess-rate plans have, and the difference grows as earnings increase. While it

Chart 1. **Selected replacement rates for integrated and nonintegrated defined-benefit plans, by years of tenure and earnings at age 65**

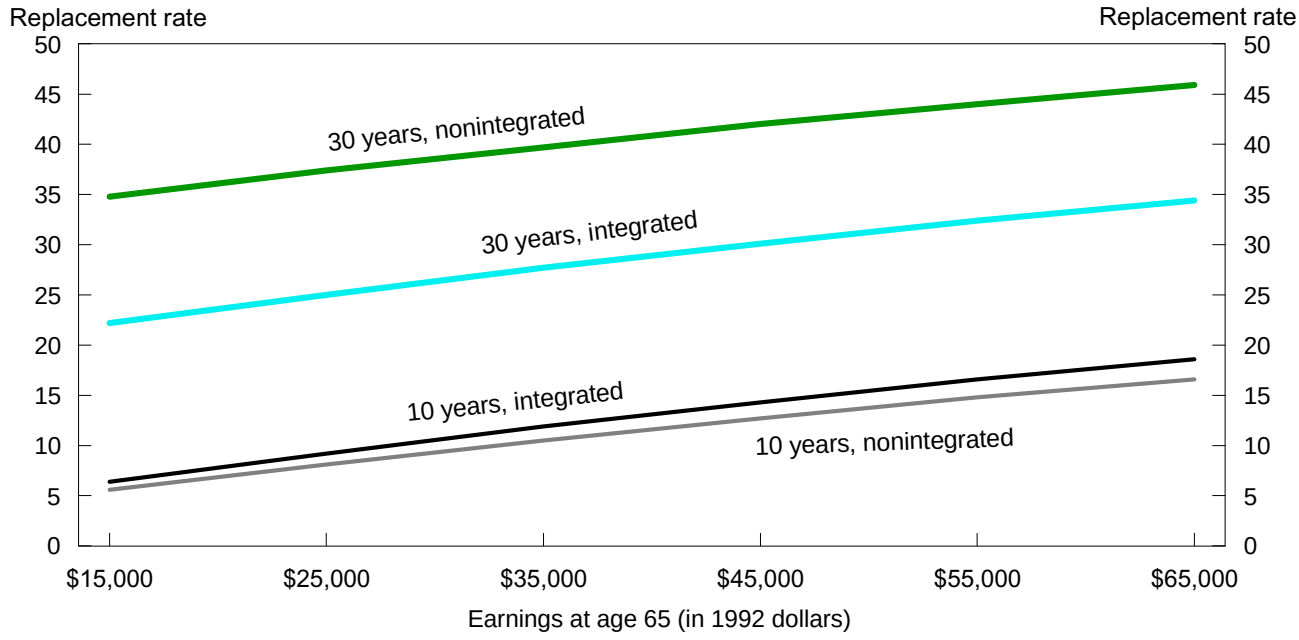
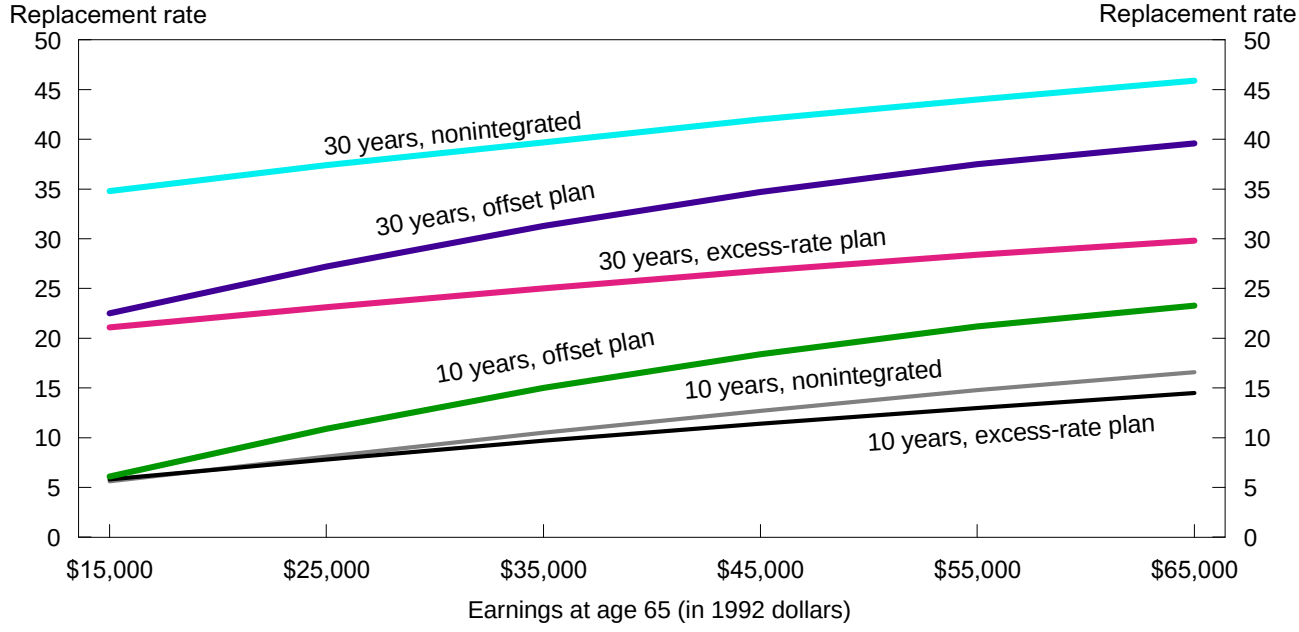


Chart 2. **Selected replacement rates of excess, offset, and noninegrated defined-benefit plans, by years of tenure and earnings at age 65**



may seem that offset plans result in lower replacement rates due to the reduction in pension benefits, the higher average accrual rates of these plans more than compensate for the offset, compared with excess-rate plans.

Second, for workers with less tenure, offset plans yield higher replacement rates than do nonintegrated plans. At higher tenure levels, the opposite is true, with nonintegrated pensions paying higher replacement rates; however, replacement rates of offset plans grow more rapidly with earnings, so the difference in rates is smaller at high earnings levels than at low earnings levels when tenure is held constant.

Third, excess-rate plans have lower replacement rates than nonintegrated plans. Indeed, the growth of replacement rates as earnings increase for excess-rate plans is slower than for nonintegrated plans, showing that excess-rate plans are apparently not used to retain highly paid workers. The differences between excess-rate and nonintegrated replacement rates can become quite large: up to 20 percentage points for high earners ($65,000) with high tenure (40 years).

Finally, recent BLS data show that there has been an increase in excess-rate plans as a proportion of integrated plans. This trend suggests that increasing numbers of people with integrated plans will be receiving substantially lower replacement rates than highly paid workers with nonintegrated plans. □

Notes

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[1] *Income of the Population 55 or Older, 1996* (Social Security Administration, 1998), table VII.2.

[2] Avy D. Graham, "Coordinating private pension benefits with Social Security," *Monthly Labor Review,* March 1994, pp. 35–38.

[3] Keith A. Bender, "Characteristics of Individuals with Integrated Pensions," *Social Security Bulletin,* vol. 62, no. 3, 1999, pp. 4–14.

[4] For a more extensive discussion of pension integration, see James H. Schulz and Thomas D. Leavitt, *Pension Integration: Concepts, Issues, and Proposals* (Washington, DC, Employee Benefit Research Institute, 1983); and Geoffrey Kollmann, Ray Schmitt, and Michelle Harlan, "Effect of Pension Integration on Retirement Benefits," *Congressional Research Service Report for Congress, 94–974* (Washington, DC, Congressional Research Service, 1994).

[5] See Bender, "Individuals with Integrated Pensions."

[6] Ann C. Foster, "Public and Private Sector Defined Benefit Pensions: A Comparison," *Compensation and Working Conditions,* Summer 1997, pp. 37–43.

[7] Note that the 1986 tax reform act did not take effect until the early 1990s, so the integration provisions in the pensions analyzed in this article are based on regulations extant before the act took effect.

[8] The term *replacement rate* has different definitions in the literature, depending on what the numerator and denominator of the ratio are construed to be. For discussions of some of the different methods used to calculate replacement rates, see Alan Fox, "Earnings Replacement Rates and Total Income: Findings from the Retirement History Study," *Social Security Bulletin,* October 1982, pp. 3–23; Michael J. Boskin and John B. Shoven, "Concepts and Measures of Earnings Replacement during Retirement," in Zvi Bodie, John B. Shoven, and David A. Wise, eds., *Issues in Pension Economics* (Chicago, University of Chicago Press, 1987), pp. 113–41; and Susan Grad, "Earnings Replacement Rates of New Retired Workers," *Social Security Bulletin,* October 1990, pp. 2–19. In addition, Jacob Antler and Yehuda Kahane, "The Gross and Net Replacement Ratios in Designing Pension Schemes and in Financial Planning: The Israeli Experience," *Journal of Risk and Insurance,* June 1987, pp. 283–97, offer an interesting twist on replacement rates by comparing replacement rates that are gross and net of income taxes. Following Graham, "Coordinating private pension benefits," the current article calculates replacement rates on the basis of estimated final-year earnings (gross of income taxes) and pension benefits calculated for retirement at age 65.

[9] Graham, "Coordinating private pension benefits."

[10] This differing compensation may be what is driving the results in Graham's table 1, which combines both offset and excess-rate plans. In the table, the replacement rates of integrated plans increase with income and eventually are larger than the replacement rates of nonintegrated pensions.

[11] Note that these arguments about excess-rate defined-benefit plans also hold for integrated defined-contribution plans.

[12] See, for example, Donald Bell and Diane Hill, "How social security payments affect private pensions," *Monthly Labor Review,* May 1984, pp. 15–20; Schulz and Leavitt, *Pension Integration*; Kollman, Schmitt, and Harman, "Effect of Pension Integration," and Chuck Slusher, "Pension Integration and Social Security Reform," *Social Security Bulletin,* vol. 61, no. 3, 1998, pp. 20–27.

[13] See Graham, "Coordinating private pension benefits."

[14] See Slusher, "Pension Integration," and Bender, "Individuals with Integrated Pensions."

[15] The data utilized in this article are the pension-covered subsample used in Bender, "Individuals with Integrated Pensions"; here, though, a newer version of the Pension Calculator is employed. (See Bender for a more thorough discussion of the data, and see also Richard T. Curtin, Jody Lamkin, and Bob Peticolas, *Employer Sponsored Pension Benefit Plans: Pension Estimation Program Documentation*, HRS/AHEAD Documentation Report DR004, University of Michigan, 1998, for details regarding the HRS/University of Michigan Pension Calculator, version 6B.) Bender finds that only 64 percent of those in the pension-covered subsample of the HRS gave detailed enough information to identify whether their plans were integrated and allow benefits to be estimated. Bender discusses the characteristics of those with missing pension data and the possible selection effects of excluding such individuals.

[16] Results based on the assumption of retirement at age 62 were similar to those based on retirement at age 65 and are available from the author upon request.

[17] The HRS asks pension-related questions only of the primary job if the respondent currently holds more than one job, or only of the most recent primary job if the respondent is not currently working. Each worker may have recorded information on up to three pensions from his or her primary job. Information on pensions from previous jobs is

not used, for continuity with Bender, "Individuals with Integrated Pensions," and for reasons given there for excluding data on previous jobs.

[18] The reason for this disaggregation is a conceptual one. If a worker had both an integrated and a nonintegrated pension, it would be difficult to assign the person to the integrated or nonintegrated pension group. By "splitting" the individual into two, one can assign his or her characteristics to each type of pension. This conceptual separation affects the 32 percent of the sample with multiple pensions. Therefore, in the analysis presented, each worker-pension observation contains information on only one pension.

[19] For example, if a respondent has a weight of 3, but participates in two pension plans, the two worker-pension observations would have weights of 1.5 each.

[20] The percentage of integrated plans in this sample is lower than in Graham's for two main reasons. First, the HRS sample includes workers from firms of any size, as opposed to just medium-sized and large firms surveyed in the EBS. Second, public-sector workers (who generally have lower rates of integration) are included in the sample used in this article.

[21] Some integrated plans have both excess-rate and offset provisions. These observations are included in both samples. There is no record or weight splitting for them, because each such observation is considered a single integrated plan.

[22] As noted by the number of unweighted observations (in parentheses) in the table, some of these averages (in particular, "other race," "firm size < 100," "natural resources," "sales," and "service" among industries, and "sales" and "construction" among occupations) are based on small sample sizes and therefore can be unduly influenced by outlying benefit values.

[23] Public-sector workers are identified, not by their affiliation to the "public administration" industry, but by the HRS job history section, which asks about employment and tenure in Federal, State, and local government. Therefore, in this analysis, the public sector is considered an industry, with the other industry indicators referring strictly to private-sector employment.

[24] See Graham, "Coordinating private pension benefits."

[25] A variant of these regressions included indicator variables from age 51 to 61 to capture any effects of real earnings growth on replacement rates and annual benefits. The coefficients on these variables were not significant and were therefore dropped.

[26] Graham, in contrast, finds a negative relationship between earnings and replacement rates of nonintegrated plans, holding years of service constant. Part of this difference in the two studies' findings may be due to their difference in pension coverage. Graham's pension sample covers private-sector plans only, while the pension plans examined in this article also include public-sector plans.

[27] Other research has found that the relationship between replacement rates and final earnings depends on the types of pensions given to different occupations. White-collar workers, who tend to have pension benefits that are based on their final-year earnings or career averages, were found to have replacement rates that were relatively invariant to final earnings. Blue-collar workers, by contrast, who tend to have their benefits determined by a flat dollar amount multiplied by the number of years of service they have accrued, were shown to have replacement rates that were negatively related to their final earnings. (See William J. Wiatrowski, "New survey data in pension benefits," 00*Monthly Labor Review*, August 1991, especially table A-1)

[28] One of the findings from Bender, "Individuals with Integrated Pensions," is that a worker is more likely to have an integrated pension if he or she has more than one pension. In addition, it is likely that benefits from an employer with one pension plan will be more generous than the benefits from any one plan from an employer that offers more than one plan, other things being equal. To explore this matter, the analysis was repeated, restricting the sample to those with only one plan. The estimated tenure and earnings coefficients were similar to the ones reported in Tables 2 and 4.

[29] See Graham, "Coordinating private pension benefits."

[30] The results from the tables are robust to the choice of retirement age. The basic patterns were generally replicated when the retirement age for workers was assumed to be 62 years rather than 65. The main difference is that, in the age-62 regressions, replacement rates increase slightly less as tenure increases.

[31] The regression coefficients of the public-sector indicator variable were positive, significant, and much larger than the regression coefficients of the private-sector industry indicators.

[32] Available from the author upon request.