This article presents a comparison of replacement rates for employees of medium and large private establishments to replacement rates for federal employees under the Civil Service Retirement System and the Federal Employees Retirement System. This analysis shows the possibility of replacement rates exceeding 100 percent for FERS employees who contribute 6 percent of earnings to the Thrift Savings Plan over a full working career. Private-sector replacement rates were quite similar for workers with both a defined benefit and a defined contribution pension plan.

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Comparing Replacement Rates Under Private and Federal Retirement Systems

*by Patricia P. Martin**

Summary and Introduction

One measure of the adequacy of retirement income is the replacement rate—the percentage of pre-retirement salary that is available to a worker in retirement. This article compares salary replacement rates for private-sector employees of medium and large private establishments with those for federal employees under the Civil Service Retirement System and the Federal Employees Retirement System.

Because there is no standard benefit formula to represent the variety of formulas available in the private sector, a composite defined benefit formula was developed using the characteristics of plans summarized in the Bureau of Labor Statistics Medium and Large Employer Plan Survey. The resulting "typical" private-sector defined benefit plan, with an accompanying defined contribution plan, was then compared with the two federal systems.

The Civil Service Retirement System (CSRS) is a stand-alone defined benefit plan whose participants are not covered by Social Security. Until passage of the 1983 Amendments to the Social Security Act, it was the only retirement plan for most federal civilian employees.

Provisions of the 1983 Amendments were designed to restore long-term financial stability to the Social Security trust funds. One provision created the Federal Employees Retirement System (FERS), which covers federal employees hired after 1983. It was one of the provisions designed to restore long-term financial stability to the Social Security trust funds. FERS employees contribute to and are covered by Social Security. FERS, which is a defined benefit plan, also includes a basic benefit and a 401(k)-type plan known as the Thrift Savings Plan (TSP).

To compare how retirees would fare under the three different retirement systems, benefits of employees retiring at age 65 with 35 years of service were calculated using hypothetical workers with steady earnings. Workers were classified according to a percentage of the average wage in the economy: low earners (45 percent), average earners (100 percent), high earners (160 percent), and maximum earners (earnings at the taxable maximum amount).

Overall, this analysis found that:

- Excluding Social Security benefits *and* TSP and defined contribution annuities, CSRS retirees have a higher pre-retirement salary replacement rate than either FERS or private-sector retirees. Private-sector retirees, however, have a higher replacement rate than their FERS counterparts.

- Including Social Security benefits *but not* TSP and defined contribution plan annuities, CSRS retirees who are maximum earners have a higher preretirement salary replacement rate (despite receiving no Social Security benefits) than FERS retirees with the same earnings. Private-sector retirees in all earnings categories have a higher replacement rate than federal retirees with the same earnings.
- Including Social Security *and* TSP and defined contribution plan annuities, private-sector retirees in all earnings categories have a higher replacement rate than all federal retirees, but their rate is close to that of FERS retirees. The rate is higher for FERS retirees than for CSRS retirees in all earnings categories.

This analysis shows that replacement rates could exceed 100 percent for FERS employees who contribute 6 percent of earnings to the TSP over a full working career. Private-sector replacement rates were quite similar for those with both a defined benefit and a defined contribution pension plan. Social Security replacement rates make up the highest proportion of benefits for the private sector's lowest income quartile group. The replacement rates for 401(k) plans and the TSP account for a higher proportion of benefits than does Social Security for all other income groups, assuming the absence of a defined benefit plan.

Description of the Plans

Variations in salary replacement rates for private-sector and federal government retirees are the result of the type of retirement plan in which employees participate. Retirement plans are classified as either defined benefit plans, which are based on employee earnings, or defined contribution plans, which are based on employee, and usually employer, contributions.

Private-Sector Defined Benefit Retirement System

In 2000, 33 percent of private-sector employees in medium and large establishments participated in defined benefit plans, 46 percent participated in defined contribution plans, and 14 percent participated in both (author's calculations using data in Bureau of Labor Statistics 2000, Table 98). There is no standardized benefit formula that can represent the variety of formulas used in the private sector to calculate retirement income and replacement rates.[1] However, the most prevalent method used to determine retirement benefit payments is a formula based on a percentage of average earnings during a specified number of years at the end of a worker's career (or when earnings are highest) multiplied by the number of years of service recognized by the plan. That formula, which is known as a terminal earnings-based formula, was used for about 48 percent of all full-time employees in medium and large private establishments in 2000 (Bureau of Labor Statistics 2000).[2]

The basic annuity is computed on the basis of length of service and the highest average basic pay earned during any 5 consecutive years of service (known as the "high-5" average pay).[3] For private-sector employees, the basic benefit is computed by multiplying 1.50 percent of the high-5 average pay times the employee's years of service.[4] Private-sector employees also receive Social Security benefits and, in this analysis, are assumed to be participating in a supplemental defined contribution plan.

The most common annual personal contribution of full-time employees in medium and large private firms (made by 48 percent of such employees) is 6 percent of salary. The most common matching provision (for 47 percent of employees) was for an employer to match half of an employee's contribution, up to the first 6 percent of earnings (Bureau of Labor Statistics 1997).[5] All other factors being equal, employees who make larger contributions should receive larger benefits than employees whose contributions are lower.

Civil Service Retirement System

The Civil Service Retirement System was created in 1920 and was the only retirement plan for most federal civilian employees until 1984. CSRS is a defined benefit retirement plan that provides retirement, disability, and survivor benefits. Agencies deduct a set percentage of basic pay (7 percent for most employees) and contribute a matching amount to CSRS.

The basic annuity is computed on the basis of length of service and the highest average basic pay earned during any 3 consecutive years of service (known as the "high-3" average pay). For most employees, the CSRS basic benefit is computed by adding:

- 1.50 percent of high-3 average pay times years of service up to 5 years, plus
- 1.75 percent of high-3 average pay times service for 5 to 10 years, plus
- 2.00 percent of high-3 average pay times service over 10 years.

The CSRS benefit may be reduced to provide survivor protection and, in some cases, for retirement before age 55 for reasons other than disability.

Under CSRS, employees do not have Social Security coverage and, as a general rule, do not receive any Social Security benefits. However, they are allowed to participate in the Thrift Savings Plan and could contribute up to 7 percent of basic pay in 2002; however, they receive no federal government match. Any TSP benefits are in addition to the CSRS defined benefit basic annuity. In general, the CSRS annuity is larger than traditional Social Security benefits because it is supposed to reflect a combination of a Social Security-like annuity and an employer pension.

Federal Employees Retirement System

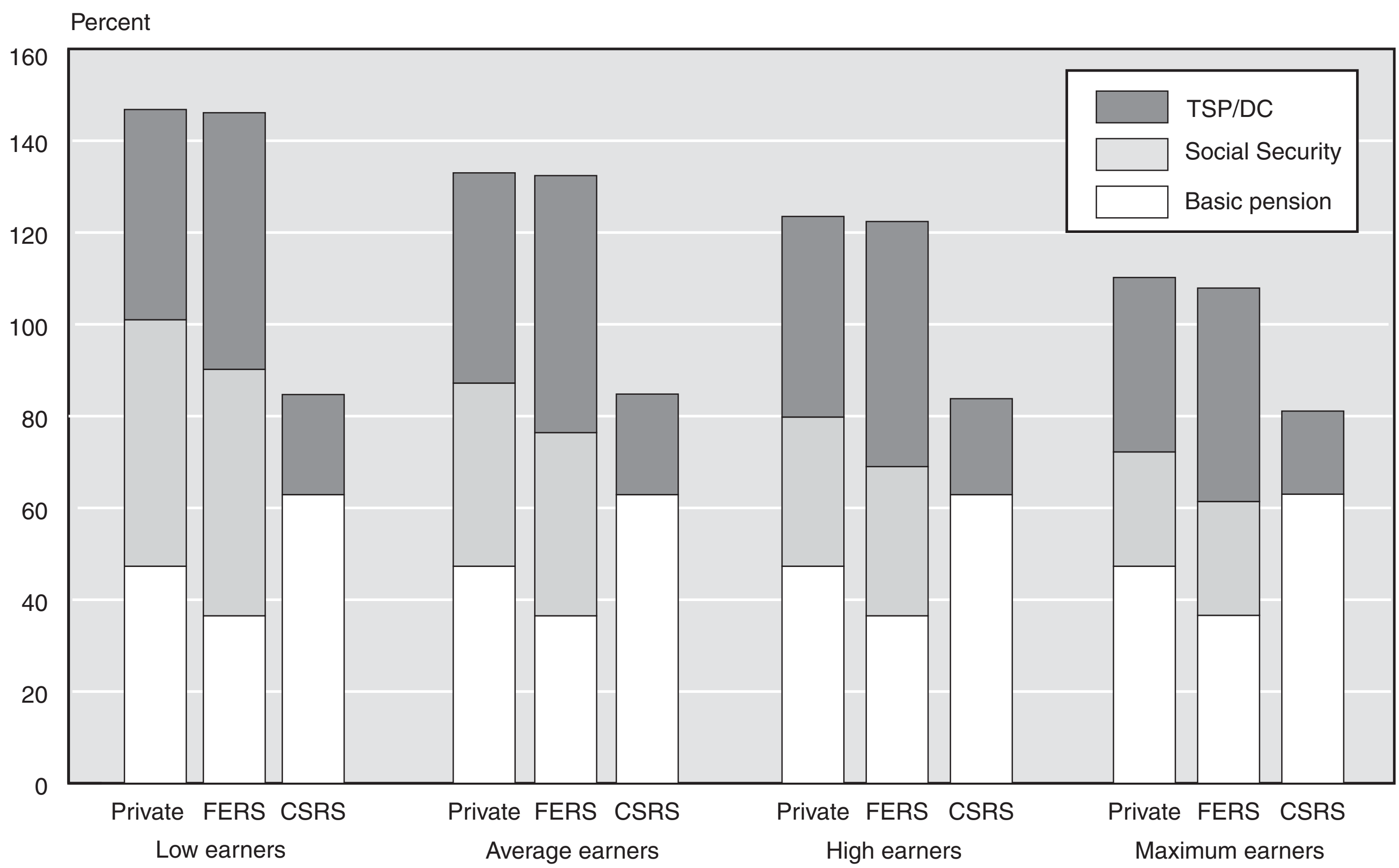
The Federal Employees Retirement System became effective in 1987 and automatically covers most new federal civilian employees hired after 1983.[6] FERS is a three-tiered retirement plan, including:

- A FERS basic benefit,
- A Social Security benefit, and
- A TSP benefit.

Employees contribute 0.8 percent of basic pay for FERS basic benefits and 6.2 percent for Social Security (up to the Social Security maximum taxable base—$84,900 in 2002), for a total of 7 percent. The employing agency contributes 10.7 percent or more of basic pay to FERS. The basic benefit provides retirement, disability, and survivor benefits and may be reduced for early retirement or to provide survivor protection.

The FERS basic benefit is computed on the basis of length of service and the highest average basic pay earned during any 3 consecutive years of service. The basic benefit is computed as 1 percent of the high-3 average pay times the employee's years of creditable

Chart 1.
Illustrative replacement rates under a composite private defined benefit plan, FERS, and CSRS



SOURCE: Author's tabulations using earnings data from the Office of the Chief Actuary. Benefit examples for workers with low, average, high, and maximum wages were accessed on September 10, 2002, at http://www.socialsecurity.gov/OACT/COLA/examples.html. Thrift Savings Plan (TSP) annuity estimates using single life annuity, level payments with no additional features were accessed on April 18, 2003, at http://www.tsp.gov/calc/annuity.html.

NOTES: FERS = Federal Employees Retirement System; CSRS = Civil Service Retirement System; TSP = Thrift Savings Plan; DC = defined contribution.

service (1.1 percent for an employee retiring at age 62 or later with at least 20 years of service).

FERS employees also receive Social Security benefits and automatically have TSP accounts whether or not they decide to contribute. In 2002, FERS employees could contribute up to 12 percent of basic pay to the TSP, with the contribution capped at $11,000. Since January 1987, all federal employing agencies have been required by law to automatically contribute 1 percent of basic pay for every FERS employee. Federal agencies also match the employee's contribution up to 4 percent of basic pay, for a total agency contribution of 5 percent of salary. (In contrast, CSRS employees could choose to contribute up to 7 percent of basic pay to the TSP in 2002 but would receive no government match.) The TSP represents an opportunity for FERS workers, particularly maximum earners, to earn a replacement rate similar to that of their CSRS counterparts.

Replacement Rates Under the Three Retirement Systems

To compare how retirees would fare under the three retirement systems, benefits of employees retiring in January 2002 at age 65 with 35 years of service were calculated using hypothetical workers with steady earnings.[7] The calculations were made for four earnings levels: low ($15,254), average ($33,897), high ($54,235),

Table 1.
Illustrative replacement rates under a composite private defined benefit plan, CSRS, and FERS (as a percentage of assumed final salary)

Benefit	Low earner[a] ($15,254)	Average earner ($33,897)	High earner[b] ($54,235)	Maximum earner ($80,400)
		Composite private defined benefit plan		
Basic pension only	47.3	47.3	47.3	47.3
Basic pension with Social Security	101.0	87.2	79.8	72.2
Basic pension with Social Security and defined contribution	146.8	133.0	123.5	110.2
		Civil Service Retirement System		
Basic pension only	62.9	62.9	62.9	63.0
Basic pension with Thrift Savings Plan	84.7	84.8	83.8	81.1
		Federal Employees Retirement System		
Basic pension only	36.5	36.5	36.5	36.6
Basic pension with Social Security	90.2	76.4	69.0	61.4
Basic pension with Social Security and Thrift Savings Plan	146.1	132.4	122.4	107.9

SOURCE: Author's tabulations using earnings data from the Office of the Chief Actuary. Benefit examples for workers with low, average, high, and maximum wages were accessed on September 10, 2002, at http://www.socialsecurity.gov/OACT/COLA/examples.html. Thrift Savings Plan (TSP) annuity estimates using single life annuity, level payments with no additional features were accessed on April 18, 2003, at http://www.tsp.gov/calc/annuity.html.

NOTES: The rates assume that employees retired in January 2002 at age 65 with 35 years of service.

The replacement rate is the percentage of the pension benefit divided by earnings in the final year of work. Since workers under all three plans are assumed to have the same hypothetical earnings and years of service, using the final year's earnings as a base allows for comparison of replacement rates across all three plans. The plans compute benefits as a percentage of terminal earnings multiplied by years of service. For federal employees, terminal earnings are the average over a 3-year period. For most private-sector employees, terminal earnings are the average over a 5-year period.

a. Calculated as 45 percent of average wages.

b. Calculated as 160 percent of average wages. Earnings between 1967 and 1973 are less than 160 percent of average wages, because that amount would have been above the taxable maximum amount. Earnings between 1974 and 2001 are 160 percent of average wages, because the taxable maximum was automatically increased in proportion to increases in the average wage level.

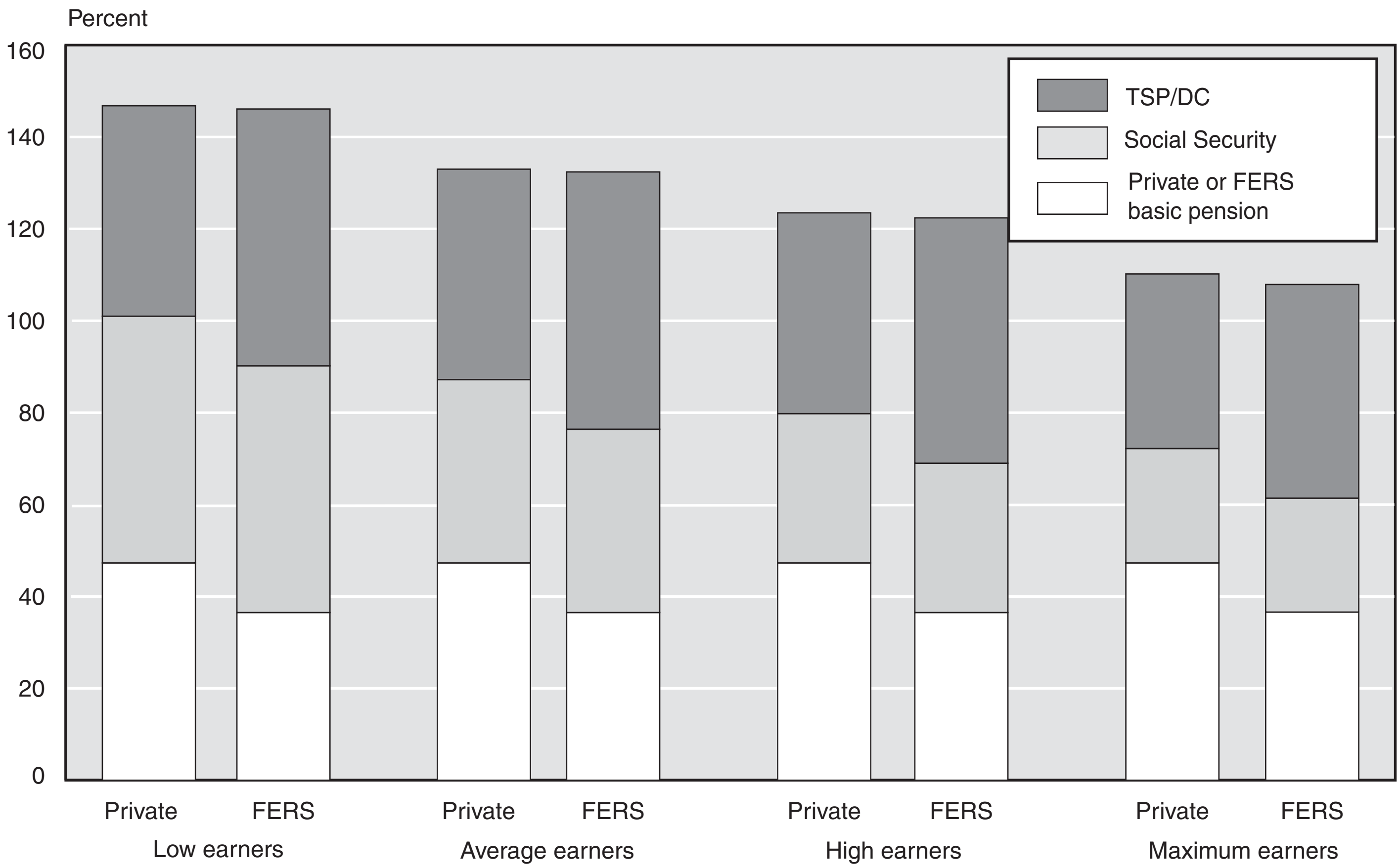
and maximum ($80,400). The comparisons are shown in Chart 1 and Table 1.

- *Basic Pension Only.* The basic pension benefit replaces 47.3 percent of the private-sector retirees' final salary. In each earnings category, that replacement rate is lower than the rate for CSRS retirees (about 63 percent) and higher than the rate for FERS retirees (about 36.5 percent).
- *Basic Pension with Social Security.* Private-sector retirees in each earnings category continue to have higher replacement rates than their FERS counterparts when Social Security benefits are added to the basic pension. The private pension benefit replaces 101.0 percent of final salary for low earners, 87.2 percent for average earners, 79.8 percent for high earners, and 72.2 percent for maximum earners (Chart 2).
- *Basic Pension with Social Security and TSP or a Defined Contribution Annuity.* Private-sector retirees in each earnings category have higher replacement rates than their FERS and CSRS counterparts when a defined contribution plan is added. The rates range from 110.2 percent for maximum earners to 146.8 percent for low earners.

Table 2 provides details about the three retirement systems.

A comparison of employee contributions to defined contribution plans shows that private-sector employees made the same contribution as FERS employees and that those contributions were higher than the ones made by CSRS employees (Table 2). For example, a private-sector or FERS employee who was a maximum earner retiring in 2002 with 35 years of services would have contributed $78,150 over 35 years compared with $56,008

Chart 2.
Illustrative replacement rates under a composite private defined benefit plan and FERS



SOURCE: Author's tabulations using earnings data from the Office of the Chief Actuary. Benefit examples for workers with low, average, high, and maximum wages were accessed on September 10, 2002, at http://www.socialsecurity.gov/OACT/COLA/examples.html. Thrift Savings Plan (TSP) annuity estimates using single life annuity, level payments with no additional features were accessed on April 18, 2003, at http://www.tsp.gov/calc/annuity.html.

NOTES: FERS = Federal Employees Retirement System; TSP = Thrift Savings Plan; DC = defined contribution.

Table 2.
Details about the three retirement systems, assuming retirement in January 2002 at age 65 with 35 years of service

	Low earner[a]	Average earner	High earner[b]	Maximum earner
	Composite private defined benefit plan			
High-5 annual salary[c] (dollars)	13,753	30,562	48,899	72,600
Final salary[d] (dollars)				
Annual	15,254	33,897	54,235	80,400
Monthly	1,271	2,825	4,520	6,700
Monthly annuity (dollars)				
Basic pension only[e]	602	1,337	2,139	3,176
Social Security[f]	682	1,127	1,467	1,660
Defined contribution[g]	582	1,293	1,975	2,550
Total, basic pension with Social Security	1,284	2,464	3,606	4,836
Total, basic pension with Social Security and defined contribution	1,866	3,757	5,581	7,386
Replacement rate (percentage of final salary)				
Basic pension only	47.3	47.3	47.3	47.3
Basic pension with Social Security	101.0	87.2	79.8	72.2
Basic pension with Social Security and defined contribution	146.8	133.0	123.5	110.2
Monthly defined contribution[g] (dollars)				
Personal contribution over 35 years	15,716	34,924	55,103	78,150
Employer match over 35 years	7,857	17,462	27,552	39,075
Account balance	82,183	182,635	279,011 [h]	360,260
	Civil Service Retirement System (CSRS)			
High-3 annual salary[i] (dollars)	14,478	32,174	51,478	76,400
Final salary[d] (dollars)				
Annual	15,254	33,897	54,235	80,400
Monthly	1,271	2,825	4,520	6,700
Monthly annuity (dollars)				
Basic pension only[j]	799	1,776	2,842	4,217
TSP[l]	278	618	944	1,218
Total, basic pension with TSP	1,077	2,394	3,786	5,435
Replacement rate (percentage of final salary)				
Basic pension only[f,k]	62.9	62.9	62.9	63.0
Basic pension with TSP	84.7	84.8	83.8	81.1
Monthly TSP annuity[l] (dollars)				
Personal contribution over 35 years	11,263	25,029	39,490	56,008
Account balance	39,265	87,259	133,305 [h]	172,124

Continued

SOURCE: Author's tabulations using earnings data from the Office of the Chief Actuary. Benefit examples for workers with low, average, high, and maximum wages were accessed on September 10, 2002, at http://www.socialsecurity.gov/OACT/COLA/examples.html. Thrift Savings Plan (TSP) annuity estimates using single life annuity, level payments with no additional features were accessed on April 18, 2003, at http://www.tsp.gov/calc/annuity.html.

NOTE: TSP = Thrift Savings Plan.

a. Calculated as 45 percent of average wages.

b. Calculated as 160 percent of average wages. Earnings between 1967 and 1973 are less than 160 percent of average wages, because that amount would have been above the taxable maximum amount; earnings between 1974 and 2001 are 160 percent of average wages, because the taxable maximum was automatically increased in proportion to increases in the average wage level.

c. Assumes this is the average of the highest 5 consecutive years of basic pay earned during any 5 (known as the "high-5" average pay).

d. Assumes this is the final salary, because the replacement rate is defined as a pension benefit divided by earnings in the final year of work.

e. Formula is 0.015 X (years of service) X high-5 salary. Formulas based on final salary are the most prevalent method (48 percent of all full-time employees in medium and large private establishments) used to determine retirement benefit payments. About 34 percent of private-sector participants in plans with such a formula have a pension benefit formula based on a flat percentage per year of service, typically 1.50 percent (Bureau of Labor Statistics 2000). A similar factor of 1.50 is used because the most common (11 percent) flat percentage per year of service ranges between 1.50 and 1.74, and the average factor is 1.48 in private plans. For most private-sector participants (78 percent), terminal earnings are the average over a 5-year period, with consecutive high-5 the most prevalent (65 percent) (Bureau of Labor Statistics 1997).

Table 2.
Continued

	Low earner[a]	Average earner	High earner[b]	Maximum earner
	Federal Employees Retirement System (FERS)			
High-3 annual salary[i] (dollars)	14,478	32,174	51,478	76,400
Final salary[d] (dollars)				
Annual	15,254	33,897	54,235	80,400
Monthly	1,271	2,825	4,520	6,700
Monthly annuity (dollars)				
Basic pension only[m]	464	1,032	1,651	2,451
Social Security[f]	682	1,127	1,467	1,660
TSP[n]	711	1,580	2,414	3,116
Total, basic pension with Social Security[o]	1,146	2,159	3,118	4,111
Total, basic pension with Social Security and TSP	1,857	3,739	5,532	7,227
Replacement rate (percentage of final salary)				
Basic pension only	36.5	36.5	36.5	36.6
Basic pension with Social Security	90.2	76.4	69.0	61.4
Basic pension with Social Security and TSP	146.1	132.4	122.4	107.9
Monthly TSP annuity[n] (dollars)				
Personal contribution over 35 years	15,716	34,924	55,103	78,150
Agency match over 35 years	13,096	29,103	45,919	65,125
Account balance	100,446	223,221	341,013 [h]	441,317

f. Assumes that workers have had steady low, average, high, or maximum earnings since age 30 and that they worked from 1967 to 2001, or 35 years.

g. Assumes an annual personal contribution of 6.0 percent of salary, the most common (48 percent), and an annual employer match of 3 percent of salary (50 percent of the contribution), the most common (47 percent), based on BLS statistics for medium and large private establishments in 1997. Assumes an ultimate average nominal portfolio yield of 7.9 percent, net of administrative costs (assuming an asset allocation of 50 percent in equities, 30 percent in corporate bonds, and 20 percent in U.S. Treasury long-term bonds), based on the Office of the Chief Actuary's (OCACT's) assumptions for the President's Commission to Strengthen Social Security.

h. Earnings between 1967 and 1973 are less than 160 percent of average wages, because earnings of 160 percent of average wages would have been above the taxable maximum amount, so the account balance is only 153 percent of the average earner's account balance.

i. Assumes this is the average of the highest 3 consecutive years of basic pay earned during any 3 (known as the "high-3" average pay). This average is used in computing CSRS and FERS pension benefits.

j. Formula is the sum of 0.015 X (up to 5 years of service) X high-3 salary plus .0175 X (over 5 and up to 10 years of service) X high-3 salary plus 0.02 X (over 10 years of service) X high-3 salary. Each sum represents a 62.9 percent replacement rate.

k. Replacement rate refers to the percentage of the pension benefit divided by the final salary. Generally the CSRS basic annuity cannot be more than 80 percent of high-3 average pay (reached after 41 years and 11 months of service) unless the amount over 80 percent is due to crediting unused sick leave.

l. Assumes an annual personal contribution of 4.3 percent of salary, an average based on TSP's experience between 1988 and 2000. Assumes an ultimate average nominal portfolio yield of 7.9 percent, net of administrative costs (assuming an asset allocation of 50 percent in equities, 30 percent in corporate bonds, and 20 percent in U.S. Treasury long-term bonds), based on OCACT's assumptions for the President's Commission to Strengthen Social Security.

m. Formula is 0.011 X (years of service) X high-3 salary. An enhanced percentage of 1.1 is used instead of 1.0 because the employee has at least 20 years of service and retires at age 62 or older.

n. Assumes an annual personal contribution of 6.0 percent of salary, an average based on TSP's experience between 1988 and 2000, and annual agency match of 5 percent of salary (4 percent match and 1 percent automatic). Assumes an ultimate average nominal portfolio yield of 7.9 percent, net of administrative costs (assuming an asset allocation of 50 percent in equities, 30 percent in corporate bonds, and 20 percent in U.S. Treasury long-term bonds), based on OCACT's assumptions for the President's Commission to Strengthen Social Security.

o. Assumes the FERS worker has retired in 2002 with 35 years of service, although most FERS employees have been in government service less than 20 years unless they are transferees from CSRS. Because the FERS program has been in existence less than 20 years, no federal employee has been employed under FERS for 35 years at this time. However, the employee could have been covered by Social Security employment for 35 years.

for a CSRS counterpart. This finding applies across all earnings categories.

Note that this analysis uses a nonintegrated benefit formula, because almost three-fifths (59 percent) of all employees in defined benefit plans are in plans without an integrated benefit formula (Bureau of Labor Statistics 2000, Table 60). The analysis does not examine replacement rates using an integrated benefit formula, in which private pension amounts are reduced if the retiree receives Social Security benefits.

Findings of a Similar Study

A study conducted in 2000 by the Employee Benefit Research Institute (EBRI) and the Investment Company Institute (ICI) provides further perspective on replacement rates (Holden and VanDerhei 2002). It estimates replacement rates (including Social Security) for workers who participate in a "typical" 401(k) plan but have no defined benefit plan. The estimates were made for participants across income quartiles for persons turning age 65 in 2005–2009, 2020–2024, and 2035–2039, using rates of return based on historical and worst-case investment scenarios.[8]

The EBRI/ICI study found that a combination of 401(k) and Social Security benefits alone could replace most or all pre-retirement earnings for an individual retiring at age 65.[9] It also found that the most significant issue affecting replacement rates at retirement is whether an individual has access to a 401(k) plan. When participants are not offered continuous coverage in a 401(k) plan throughout their working lives, their projected replacement rates are reduced significantly.

Assuming continuous coverage and equity returns based on the performance of the Standard & Poor's 500 between 1926 and 2001, the study estimated a replacement rate of 103 percent for low earners and about 85 percent for the other three earnings categories. These findings are comparable with the replacement rate of 147 percent for low earners and a range of 133 percent to 110 percent for the average, high, and maximum private-sector earners reported in this article. However, unlike the EBRI/ICI study, this analysis estimates replacement rates (including Social Security) for workers who participate in a "typical" 401(k) plan *and* a defined benefit plan, which partly explains why the replacement rates are higher than those in the EBRI/ICI study.

Discussion

The analysis presented here shows that replacement rates could exceed 100 percent for FERS employees who contribute 6 percent of earnings to the TSP over a full working career. Replacement rates for hypothetical private-sector workers were quite similar for those with both a defined benefit and a defined contribution pension plan. Very few private-sector workers are likely to receive such high replacement rates, however, because only 14 percent of employees in medium and large firms participate in both types of plans, and even fewer will be covered by both types of plans for their entire career.

Since private-sector employees are more likely to have a defined contribution plan as their primary plan, whereas federal civil service employees' primary plan is a defined benefit plan, the results from the new EBRI/ICI study are particularly relevant. It found that a combination of 401(k) and Social Security benefits alone could *replace most or all* pre-retirement earnings when an individual retires at age 65. The study's findings confirm that Social Security replacement rates make up the highest proportion of benefits for the lowest income quartile group, and that 401(k) replacement rates make up the highest proportion of benefits for the highest income quartile group.

In this analysis, Social Security replacement rates also account for the highest proportion of benefits for the private sector's lowest income quartile group. However, 401(k) and TSP replacement rates account for a higher proportion of benefits than Social Security for all other income groups, assuming the absence of a defined benefit plan. TSP replacement rates are proportionately lower for CSRS employees, because those employees do not receive any employer match and their TSP contributions are limited to about half of what FERS employees can contribute.

One possible reason for the similar replacement rates for private-sector and FERS retirees is that although FERS was originally designed to replicate a typical large-company retirement plan when it was enacted in 1986, it is more generous than the plans offering only a defined contribution that private companies have established in recent years. However, federal employees with defined benefit coverage have to contribute to its cost (FERS employees contribute 0.8 percent of basic pay toward their benefits), and the benefits of the majority (95 percent) of participants in medium and large private firms in 2000 were paid for entirely by their employers.

Notes

[1] In terms of a primary benefit formula and the availability of alternative formulas, there are several major breakdowns for full-time employees working for medium and large employers. Even within these major formula breakdowns, there is still a great deal of variability.

[2] Due to the increase in the incidence of cash balance plans (23 percent in 2000, up from 6 percent in 1997), the prevalence of some provisions in defined benefit plans has declined from earlier surveys. The percentage of terminal earnings as a

primary benefit formula declined from 61 percent in 1994 to 48 percent in 2000. (Cash balance retirement plans are a defined benefit plan in which an account is maintained for each participant; employer contributions based on employee earnings, plus interest, are credited to that account. Cash balance plans generally do not have provisions for many of the features found in traditional defined benefit plans.)

[3] This analysis calculates replacement rates by dividing the pension benefit by earnings in the final year of work. Since workers under all three retirement systems are assumed to have the same hypothetical earnings and years of service, using the final year's earnings as a base allows for a comparison of replacement rates across all three plans. The plans compute benefits as a percentage of terminal earnings multiplied by years of service. Terminal earnings are the average over a 5-year period for most private-sector employees and over a 3-year period for federal employees.

[4] About 34 percent of private-sector participants in plans with a terminal earnings formula have a pension benefit formula based on a flat percentage per year of service, typically 1.50 percent. That formula was used to construct a composite formula, since the most common flat percentage per year of service (for 11 percent of participants) ranges between 1.50 and 1.74 and the average factor is 1.48 in private plans. For most private-sector participants (78 percent), terminal earnings are defined as the average of an employee's earnings over a 5-year period, with high consecutive 5 the most prevalent (65 percent). (See Bureau of Labor Statistics 1997, 2000.) The factor of 1.50 is based on 1997 BLS data because it was unavailable in 2000 BLS data.

[5] The 2000 National Compensation Survey does not include a category of 6 percent since the results for this category were not publishable, but William Wiatrowski of BLS confirmed that the prevalent contribution rate in 2000 was still 6.0 percent with a 50 percent match, the same as in 1997.

[6] A civil service interim plan covered employees hired from 1984 through 1986. Their contributions were later reallocated to their correct retirement system in 1987. There were no catch-up provisions. Employees of other federal entities, including the Postal Service, uniformed services, and the legislative and judicial branches, may have different payroll systems but are still part of the same general retirement system.

[7] The analysis was also done using scaled workers, and the results were similar. However, the calculated replacement rates for scaled workers were somewhat higher than for steady workers. The reason is that the analysis focuses on the worker's final 35 years of work experience (ages 30 to 65), and scaled earnings patterns concentrate earnings later in a career.

[8] The *baseline projection scenario* assumed that future equity returns would be similar to historical returns experienced by the S&P 500 from 1926 to 2001. The S&P 500 equity returns used in the analysis are from Ibbotson Associates, as quoted in the EBRI/ICI report. The Ibbotson series used is "large company stock returns." Historically, about two-thirds of the time, equity returns in any given year are between –7 percent and 33 percent. In this scenario, if an average participant in his or her 20s with the average asset allocation for that age group were to experience an average year, he or she would have a projected nominal return of about 9¾ percent compared with 8½ percent for an average participant in his or her 60s in the baseline case. The *worst-case scenario* assumed that future equity returns would be similar to the worst historical 50-year period for the U.S. equity market throughout the entire projection period. (EBRI and ICI based their data collection project on an analysis of 2.5 million 401(k) participants drawn from the year-end 2000 database. That project is the most comprehensive source of 401(k) plan participant-level data available to date. The data cover a wide variety of plan administrators and recordkeepers and, therefore, a wide range of plan sizes offering a variety of investment alternatives.)

[9] When referring to the EBRI/ICI paper, note that replacement rates were based on the average earnings over a 5-year period; hence, rates will be slightly higher than if only the final year of work was used. Replacement rate as defined in the EBRI/ICI study is based on an individual's initial annual retirement income generated by projected 401(k) accumulations, Social Security benefits, or both compared with his or her projected 5-year average salary immediately before retirement. In contrast, this analysis calculates replacement rates based on earnings in the final year. This refers to the percentage of the pension benefit divided by earnings in the final year of work.

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