CBO MEMORANDUM

COMPARING FEDERAL SALARIES WITH
THOSE IN THE PRIVATE SECTOR

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For years, analysts have pondered the question of how the salaries of federal and private-sector employees compare. They often arrive at very different conclusions. This memorandum offers a new look at salary comparisons. The analysis was undertaken as background research in support of the Congressional Budget Office's (CBO's) work on options for reducing the deficit. It will also help CBO maintain the integrity of the model it keeps for projecting the cost of federal pay.

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Sherwood Kohn edited the manuscript, and Chris Spoor proofread it. L. Rae Roy prepared the memorandum for publication.

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SUMMARY

How do salaries for federal and nonfederal white-collar employees compare? The government's comparisons, based on data collected by the Bureau of Labor Statistics (BLS), show federal salaries lagging well behind those outside of government. Such comparisons focus on pay for similar jobs and have been much criticized over the years. By contrast, some comparisons by labor-market analysts have maintained that federal employees are substantially overpaid. Those comparisons center on employees who have similar "human-capital" characteristics such as education, skill, and work experience. The apparent contradiction in the results of the two approaches has cast doubt on the federal pay process and comparisons.

This analysis suggests a two-part explanation for the differing results. First, past human-capital comparisons may overstate the gap between federal and private-sector salaries. The more fully developed comparisons presented in this memorandum show no significant difference in federal and private-sector salaries for employees who have similar characteristics. The second part of the explanation deals with the different ways in which the federal government and the private sector use workers. More specifically, the federal government in many cases appears to place employees with given levels of education, experience, and other human-capital characteristics in higher-ranking positions than the private sector.

The analysis in this memorandum is limited to a consideration of federal pay —that is, cash wages. In future work, the Congressional Budget Office (CBO) plans to examine how federal employee benefits compare with those of nongovernment employees. Employee benefits are nonpay forms of compensation, such as vacation and health insurance. Many people argue that federal benefits, especially for retirement, are more generous than those offered by private firms. Other benefits, including health insurance, may be less generous. The way in which the overall benefit package affects comparisons of total compensation is not clear at this time.

The Federal Pay System and the Government's Pay Comparisons

Comparability with salaries outside of the government has been a guiding principle of federal pay-setting for decades. Under current procedures, authorized by the Federal Employees Pay Comparability Act of 1990, most of the government's 1.6 million white-collar employees may receive raises each January designed to make federal pay gradually comparable to rates that prevail in various geographic locations.

In determining what raises would be necessary to achieve comparability in different localities, the government compares federal salaries with those in private firms and state and local governments. The process, in broad outline, works as

follows: first, the Bureau of Labor Statistics conducts surveys of nonfederal salaries for a selected sample of jobs that are similar to those held by federal employees; the Office of Personnel Management then compares the nonfederal rates with federal salaries; and finally, based on those comparisons, the government determines what raises would, on average, bring federal salaries to the level of nonfederal rates.

Estimates for 1996 showed federal salaries lagging behind salaries outside of government by an average of 22 percent; the government would have to grant large raises over time to achieve comparability. The government has seldom granted such raises, partly in order to control federal costs and partly out of concern for the limitations of its own pay-setting process. BLS pay surveys, in particular, have been under scrutiny, and many decisionmakers question the existence of a large federal pay disadvantage, or pay gap.

Human-Capital Pay Comparisons

Pay comparisons based on human-capital characteristics have cast further doubt on the results of federal pay surveys. In contrast to federal comparisons, which focus on similar jobs, human-capital comparisons focus on individuals with similar pay-related characteristics. In the past, that approach has generally led to the conclusion that federal employees are overpaid. More detailed comparisons, however, indicate that federal employees earn about what they would in the private sector for the human capital they possess.

In general terms, the human-capital method statistically tests whether the sector of employment (either federal or private) affects pay—when holding constant other characteristics related to pay. If, for example, federal employment was associated with higher salaries than jobs in the private sector, other worker characteristics being constant, one might conclude that the government overpays for a given level of human capital.

The human-capital analysis reported here improves on earlier efforts by incorporating two worker characteristics not included in earlier studies: job tenure and aptitude. The analysis includes data on job tenure because it seems likely that time spent with a specific firm or in government might affect wages independently of the effect of general work experience on wages, a factor already incorporated into most equations. The data on aptitude, represented by scores on the Armed Forces Qualification Test, allow for an explicit attempt to sort individuals on the basis of ability. The data on workers' pay and other characteristics were derived from the National Longitudinal Survey of Youth.

CBO conducted its analysis in several stages. The first stage involved checking whether the database selected was comparable to those that other organizations used in earlier comparisons. In doing so, CBO tried to reproduce the results of those earlier comparisons. That duplication, which lacked controls for tenure and aptitude, showed federal employees being overpaid—suggesting that the database is reliable and that any differences between CBO's results and those of earlier efforts do not simply reflect variations in data.

The final stage of CBO's analysis involved incorporating data on job tenure and aptitude into comparisons. Using that expanded approach, several tests for a federal pay advantage found no significant evidence that the federal government overpays or underpays for a given level of human capital.

Reconciling the Results of Different Pay Comparisons

The expanded human-capital analysis that CBO prepared significantly reduced the difference between the results produced by the human-capital approach to pay comparisons and the approach used in federal pay-setting, but differences remain. Why do pay comparisons involving similar jobs show that federal employees are underpaid in relation to workers in the private sector, but a comparison focusing on similar salary-related employee characteristics suggests no significant differences in federal and private pay? One possible explanation is that the federal government and the private sector utilize workers in different ways.

For example, an entry-level accountant might earn $35,000 a year in a private-sector firm. If the federal government hires the same person at the same salary to do senior-level accounting, a comparison of jobs would show that the government underpays; its salary for senior-level accountants, $35,000, is what the private sector pays junior accountants. A comparison of people with the same experience and other job-related characteristics would, however, show that the government pays about the same as the private sector: the accountant would earn $35,000 in government or in private industry. What appears on the surface as a contradiction in results is reconciled by the observation that the government would give the worker greater responsibility than would a private firm.

How the Government Ends Up Utilizing Workers Differently. How can the government place an employee in a higher-level position than a private firm would? Federal managers may hire relatively less-experienced, less-educated employees for some jobs because government cannot attract more qualified employees with the low pay it offers for those positions.

Federal managers may also promote employees to higher-level positions as a way of raising pay and making salaries more competitive. Indeed, the government employs a relatively large portion of its workers at the upper pay grades. In 1995, for example, half of all federal white-collar employees held jobs at the top five pay grades of the 15-grade General Schedule pay plan that covers most such workers.

The human-capital comparisons add evidence to the picture that for the capable people it is able to recruit for federal service, the government pays about private industry's going rate.

Supporting Evidence. One of the few studies that examines differences in the ways in which the government and private sector utilize workers offers some support for CBO's hypothesis. That analysis used data specially commissioned as part of BLS pay surveys, along with data from the Office of Personnel Management and the Current Population Survey, to identify differences between the characteristics of federal and private-sector workers who held the same type of job. Using a variety of statistical techniques, the study found that given workers' education, experience, and other characteristics, the federal government places them at higher levels of responsibility than does the private sector.

An earlier CBO study compared the job rankings and salaries of a selected group of federal workers and their counterparts in private firms. In that comparison, the federal government had a disproportionate share of its jobs at higher levels, but similar salary distributions. Those findings lend further support to the view that in some cases the government may compensate for low salaries by using employees in higher-level positions.

Conclusion

One explanation of the contrasting results of different pay comparisons suggests that the relatively low pay that the federal government offers for many jobs may be leading federal managers to accept workers with less experience, education, and other human-capital characteristics than would private-sector managers. The CBO human-capital analysis indicates, however, that the government pays about the going rate for workers it is able to recruit.

INTRODUCTION

Pay for federal white-collar employees will total about $80 billion in 1997, representing about 5 percent of all federal spending. The government sets pay increases for most of its white-collar workers under complicated procedures intended to keep federal pay rates comparable to those of private employers and state and local governments. Comparisons of federal and nonfederal pay, however, have generated considerable controversy. The comparisons used for federal pay-setting, based on surveys conducted by the Bureau of Labor Statistics (BLS), consistently find that federal salaries lag far behind those outside of the government. Such findings mean that the government would have to grant large pay raises to make federal salaries comparable to nonfederal salaries—increases the government has consistently refused to grant. By contrast, some studies conducted by labor economists and others have shown that federal employees, far from being underpaid, are substantially overpaid. The apparent contradiction in results has vexed policymakers for decades.

Why the differing results? This Congressional Budget Office (CBO) analysis proposes a two-part answer: first, many labor-market studies may in the past have overstated federal pay premiums. The more fully developed comparisons presented in this memorandum show no significant differences in federal and private-sector salaries for employees with similar characteristics. The second part of the answer may have something to do with the ways in which the federal government and the private sector utilize workers. More specifically, given workers who have certain characteristics, the federal government appears to place them at a higher level than would the private sector.

OVERVIEW OF FEDERAL EMPLOYMENT AND PAYROLL

Federal employees account for about 2 percent of the nation's workers and have 850 different occupations. They work in more than 100 agencies, and dozens of pay plans govern their wages and salaries.

Most federal employees hold jobs in such white-collar occupations as secretary or engineer and represent about 89 percent of the federal payroll (see Table 1). Blue-collar employees, in such jobs as plumber or electrician, make up about 14 percent of federal employment and about 11 percent of the federal payroll. Most federal blue-collar employees work for the Department of Defense.

Pay for most federal white-collar employees is governed by a table of salaries referred to as the General Schedule (GS). The rates in that schedule are intended to reflect comparable salaries in the private sector and in state and local governments. The GS workforce and its pay is the primary focus of this report.

TABLE 1. FEDERAL CIVILIAN EMPLOYMENT AND PAYROLL BY PAY CATEGORY, 1995

Category	Employment[a]		Payroll	
	Thousands of Workers	Percentage of Total	Billions of Dollars	Percentage of Total
Blue Collar	268.7	14	8.6	11
White Collar				
Executive pay	8.0	b	0.9	1
Foreign Service	13.0	1	0.8	1
Veterans Affairs doctors and nurses	42.3	2	2.3	3
General Schedule	1,417.1	76	57.5	76
Other white collar	117.8	6	5.8	8
Subtotal	1,598.3	86	67.2	89
Total	1,867.0	100	75.9	100

SOURCE: Congressional Budget Office using data provided by the Office of Personnel Management.

NOTE: Data cover employees in the executive branch and those on full-time work schedules. They do not cover the Postal Service, which has a separate pay system.

a. As of March 1995.

b. Less than one-half of 1 percent.

The General Schedule is the government's largest pay plan, covering 76 percent of all employees. The payroll for those employees totaled at about $58 billion in 1995, or approximately 76 percent of the government's total payroll. About 80 percent of all GS employees hold jobs in occupations that the government designates as professional, administrative, or technical. Those occupations include engineer, lab technician, and personnel manager. Most of the remaining employees hold jobs in occupations designated as clerical, such as clerk-typist.

The General Schedule itself consists of 15 pay grades. Each grade has a salary range divided into 10 salary steps. The government assigns jobs to a grade primarily on the basis of duties and responsibilities. Under that system, lesser-skilled, lower-paid jobs are in the lower grades. Most mail and file clerks, for

example, are at GS grades 3, 4, and 5. Higher-skilled jobs are in the upper grades; most aerospace engineers, for example, are at GS grades 12, 13, and 14.

Progress up the 10 salary steps within each grade depends largely on length of time spent in a grade. Employees must complete one year of satisfactory service to move to GS steps 2, 3, and 4. They must complete two years of satisfactory service to move to each of the next three steps, and three years to move to steps 8, 9, and 10. (Agencies may advance employees faster for outstanding performance.) Step increases generally boost pay by about 3 percent.

Under the current system, pay at any given grade varies from area to area depending on how federal and nonfederal rates compare. The base salaries—that is the salaries before local pay is factored in—range from $12,669 for a GS grade 1, step 1, to $92,161 for a GS grade 15, step 10 (see Table 2). With locality adjustments, the top salary of the General Schedule may total more than $100,000; other special pay supplements designed to help the government recruit and retain workers push the figure higher. Grade 10 is roughly the median GS grade.

In preparing this report, CBO looked at analyses and data from a wide variety of sources. Taken together, the information paints a fairly consistent picture of the consequences of federal pay and personnel practices. The analysis, however, may be most relevant in explaining the current state of affairs for highly skilled and graded professional, administrative, and technical jobs. Those are the jobs that the government generally finds have the largest pay disadvantages in relation to the private sector.

The scope of this analysis is limited to federal pay. A complete understanding of federal personnel and pay practices would have to consider the full compensation package, including benefits such as retirement and health insurance. Those benefits, and especially retirement, are generally considered more generous than those offered by many private firms (see Box 1). In future analyses, CBO plans to compare federal benefits with those in the private sector. Pay, however, remains the largest and most important element of the federal compensation package.

THE CURRENT FEDERAL GENERAL SCHEDULE PAY SYSTEM AND PAY COMPARISONS

Comparability has been a guiding principle of federal pay-setting for decades. Under the current system, authorized by the Federal Employees Pay Comparability Act of 1990 (FEPCA), pay rates may be adjusted to approximate rates in different localities. Thus, pay scales vary from area to area. The locality pay system replaced a system

TABLE 2. PAY AND EMPLOYMENT OF THE GENERAL SCHEDULE WORKFORCE

Grade	Salary Range (Dollars)[a]	Percentage of General Schedule Workforce[b]
1	12,669 - 15,844	c
2	14,243 - 17,928	c
3	15,542 - 20,204	2
4	17,447 - 22,685	6
5	19,520 - 25,379	11
6	21,758 - 28,283	7
7	24,178 - 31,432	10
8	26,777 - 34,814	3
9	29,577 - 38,451	10
10	32,571 - 42,345	1
11	35,786 - 46,523	14
12	42,890 - 55,760	16
13	51,003 - 66,303	12
14	60,270 - 78,351	6
15	70,894 - 92,161	3
All Grades	12,669 - 92,161	100

SOURCE: Congressional Budget Office using data provided by the Office of Personnel Management.

a. Salaries are those that became effective in January 1997. They are base rates that do not reflect locality-pay differentials or other pay supplements designed to boost the government's efforts to recruit and retain employees.

b. Full-time executive branch workers as of March 1996.

c. Rounds to less than 1 percent.

under which the government sought to make pay comparable on a national basis. Under that system, a grade 5 secretary in Syracuse, New York, would have had the same salary range as a grade 5 secretary in Washington, D.C.

Job similarity is the focus of the federal pay-setting process. That is, the goal is to make federal pay like that for similar nonfederal jobs in various localities. The process, in broad outline, is intended to work as follows: first, the Bureau of Labor Statistics conducts surveys of nonfederal salaries for a selected sample of jobs that are similar to those held by federal employees. Then, the Office of Personnel Management (OPM) takes the data on nonfederal rates and compares them with

BOX 1.
FEDERAL BENEFITS

In total, the federal benefits package is considered more generous than that offered by most private firms. The major benefits are retirement and health insurance. Federal retirement is the benefit offering the largest advantage compared with practice outside government, although uncertainty about the future reduces the value that employees assign to retirement benefits. Health insurance offered by the government under the Federal Employees Health Benefits (FEHB) program, by contrast, often appears to be less generous than coverage offered by many firms—primarily because federal employees contribute more for coverage. That is rapidly changing, however, and the disadvantage may not offset the relative generosity of federal retirement.

Most federal employees are covered by one of two major retirement systems. The Federal Employees' Retirement System (FERS) covers civilian employees hired since January 1984. FERS employees participate in Social Security. To supplement that coverage, employees are also covered under a defined-benefit pension plan and a tax-deferred thrift plan that includes matching employer contributions. In 1995, about 1.4 million employees participated in FERS (including employees of the U.S. Postal Service). The Civil Service Retirement System (CSRS) covers employees hired before 1984. It provides benefits based on years of service, age, and salary. In 1995, CSRS covered about 1.4 million employees (including the U.S. Postal Service). CSRS employees do not receive coverage under Social Security.

Benefits provided under both FERS and CSRS are relatively generous. Certainly federal employees do better than the large number of private-sector workers who are covered by Social Security alone. But even by the standards of medium and large firms, federal employees generally fare well. Few plans outside of government for example, permit employees to retire with full benefits as early as do CSRS and FERS, nor do they provide retirees with the same protection against inflation. The employer matching contribution in the thrift plan covering FERS employees is also generous—up to 5 percent of pay, compared with the private sector, where the typical practice is less than 4 percent of salary.

The FEHB program provides health insurance coverage for over 4 million active federal employees and annuitants, as well as their 4.6 million dependents and survivors. Two important differences separate the FEHB program from health insurance coverage provided by private employers. First, participants choose from among many health insurance plans that offer varying levels of benefits and premiums, and they can switch plans annually. By contrast, many private-sector employees are offered no choice among plans, although larger firms tend to offer several alternatives. Second, the government and participants jointly finance the coverage through premiums. Many large private employers pay the entire cost of covering an individual employee, but an increasing number are requiring contributions from employees.

SOURCE: Information on benefits in the private sector is from Hay Group, *1996 Hay/Huggins Benefit Report* (Philadelphia, Pa.: Hay/Huggins Company, 1996).

federal salaries. Finally, on the basis of those comparisons, the government determines what raises would, on average, bring federal salaries to the level of nonfederal rates in various localities. The government has seldom put into effect the raises determined under that process. Out of concern for continuing federal budget deficits and skepticism about its own pay process, the government has for decades capped raises below what would be needed to reach comparability. Such alternative adjustments are allowed by law.

Federal Pay Surveys

The BLS surveys that are used for setting federal pay cover nonfederal establishments with 50 or more employees. The firms surveyed represent all nonagricultural industries including communications, construction, finance, retailing, and transportation. Surveys also cover state and local governments. Survey experts visit establishments and collect data on salaries for jobs that they find that correspond to official descriptions of federal jobs included in the survey. OPM develops those descriptions in collaboration with BLS on the basis of official job standards that set out the duties and responsibilities of most jobs in government. One continuing concern, discussed later in this memorandum, is that federal employees may not actually perform at the level set forth in the job descriptions. BLS tests descriptions to make sure they are relevant to work performed outside the federal government.

BLS collects data for a sample of the more than 450 federal white-collar occupations. Surveys supporting pay raises that the government recommended for 1997 covered 25 different occupations spanning 107 different jobs. (The 25 occupations in federal surveys are very closely related to another 25 similar, federal occupations). Those jobs represent about one-third of the General Schedule workforce. (In this discussion, a job refers to work of a given level in an occupation—for example, entry-level secretary. Occupations in a BLS survey often cover several levels of work. Generally, work levels correspond to grades of the General Schedule.)

Using Pay Survey Data to Calculate Pay Gaps

After collecting data on nonfederal salaries, the government reduces that data to averages. Calculation of any federal pay disadvantage—often referred to as a pay gap—involves comparing average nonfederal with federal salaries. In calculating averages, the government uses a combination of national and local federal employment weights. That practice helps ensure that the strength with which a nonfederal job influences final averages is in proportion to the representation of that job in the federal workforce. Under the locality-pay system, gaps are calculated separately for

different localities. For 1997, the government established 30 locality-pay areas, including one designated as the "rest of the U.S."

Using Pay Gaps to Determine Recommended Pay Raises

Under FEPCA, the government uses information on pay gaps to develop recommendations for raises designed to reduce those gaps and bring federal salaries into line with those outside of the federal government. The recommended raises are made up of two parts: one, called the locality raise, helps federal salaries catch up to those outside of government; the other, called herein the across-the-board adjustment, helps keep federal salaries from falling farther behind. Under law, the government is free to grant raises below the full level recommended and has generally opted to do so. Pay raises take place in January of each year.

Locality adjustments, if granted in full, are designed to reduce pay gaps and move federal salaries, in nine annual installments, to within 5 percent of nonfederal levels. The first of the nine adjustments took place in 1994. Locality adjustments vary from area to area depending on the size of the pay gap in each.

The across-the-board part of annual raises is designed to approximate changes in pay outside of government as measured by the employment cost index (ECI).[1] When granted in full, a raise equals the change in the ECI over a 12-month period minus one-half of 1 percentage point. Such raises help the government keep pay abreast of changes in pay in the private sector.

Pay Gaps, Pay Raises, and Projections

If the government had granted the full raises specified under FEPCA in 1997, pay for employees would have risen by an average of about 7.8 percent—5.4 percent for locality raises and 2.3 percent for across-the-board ECI adjustments. (The locality raises reported here are averages of raises that vary by locality.) Adjusted for pay raises granted through 1996, the government-estimated pay gaps stand at an average of 22 percent—ranging from a high of 35 percent in Houston, Texas, to a low of 18 percent in the "rest of the U.S."

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1. The employment cost index tracks quarterly changes in labor costs. The index incorporates adjustments so that the measured changes in costs are free from the influence of shifts in the distribution of employees among industries and occupations. The index used for setting federal salaries covers pay for employees in private industry.

TABLE 3. GENERAL SCHEDULE PAY AND PAY RAISES UNDER ALTERNATIVE ASSUMPTIONS, 1998-2002

	1998	1999	2000	2001	2002	Five-Year Average
CBO's Baseline Pay Raises						
General Schedule Payroll (Billions of dollars)	78	80	83	85	89	83
Projected Raises (Percent)	3.0	2.6	3.1	3.2	3.3	3.2
Full Pay Raises Under Law						
General Schedule Payroll (Billions of dollars)	81	86	91	96	101	91
ECI Raises (Percent)	2.8	2.1	2.4	2.8	2.8	2.7
Locality Raises (Percent)[a]	7.1	2.4	2.5	2.5	2.6	3.6

SOURCE: Congressional Budget Office

NOTES: The pay raises described are the average increases in pay for employees who receive them. Some employees—for example, those who receive special pay rates designed to help the government recruit and retain employees—do not receive full pay raises.

ECI = employment cost index.

a. Locality raises are averages of raises that vary by locality.

In baseline projections, CBO estimates that annual pay raises for federal white-collar workers for the 1998-2002 period would average just over 3 percent—equal to the full increase in the ECI (see Table 3). Those raises would push the General Schedule payroll from $78 billion in 1998 to $89 billion in 2002.

If the government chose to grant increases at the level necessary to reach comparability under FEPCA, raises would average more than 6 percent—2.7 percent for ECI-based raises and 3.6 percent for locality raises. Those raises would push the General Schedule payroll to $101 billion by 2002.

Concerns About the Government's Pay Comparisons

For years, critics have charged that federal surveys skewed government estimates of the gap between federal and nonfederal salaries upward because they failed to cover small firms, state and local governments, and a sufficient variety of occupations. BLS and OPM responded with repeated refinements of federal surveys. Current surveys incorporate many long-urged reforms including coverage of state and local governments. They also cover more small firms and include more jobs than many past surveys. In 1979, for example, BLS surveys covered firms with a minimum of 50, 100, or 250 employees, depending on the industry being examined. By 1990, the minimum firm size had been lowered to 50 employees for all industries.

One of the most persistent of the remaining concerns about BLS surveys is that the sample of jobs in surveys is not random. Rather, the government chooses jobs for its surveys if they have a large federal representation and if they will produce an adequate amount of suitable data from nonfederal sources. Some critics believe that the current list of jobs for which BLS collects data has too many jobs that are higher paying outside of government—thus skewing estimates of the pay gap upward. In addition, say critics, because BLS collects data only for jobs that correspond to detailed descriptions of jobs on its list, little data is collected from smaller, often lower-paying firms.[2]

Partly in response to such concerns, BLS plans to adopt random sampling and other reforms, which could mean that federal pay comparisons will include more data from a greater variety of jobs and smaller firms. The first pay raise to be affected by full implementation of the reforms, referred to as "Comp 2000," is scheduled to occur in January 2000.

Critics also note that federal estimates of the pay gap, even if accurate, disguise wide variations in pay disparities among jobs. Data show that even within localities, pay gaps vary widely by grade and occupation. Generally, higher-skilled professional, administrative, and technical jobs have above-average pay gaps. Data for the 1995 pay adjustment, for example, showed the pay gap for jobs in professional occupations was 10 percentage points higher, on average, than the 27 percent gap for all jobs. Lower-skilled jobs, on the other hand, have below-average

2. Whether pay comparisons should involve all private or only large firms is an open question. The work of labor-market experts almost always shows that large firms pay more. It is a reasonable assumption that market forces lead large firms to such compensation practices as adaption to unique circumstances associated with size. Analysts, however, do not agree about those circumstances. Some people, for example, argue that large firms pay more because their workers have more firm-specific training. If the government shares some of those unique circumstances, large firms would appear to be the appropriate comparison group. It is not clear, however, whether government shares those circumstances and how important they are in influencing pay levels.

gaps, and some clerical jobs have no pay gap. (Clerical jobs in certain metropolitan areas, however, have significant pay gaps.)

Official estimates, note critics, may also misstate the pay disparities for jobs if those jobs have incorrect pay grades. The federal classification system assigns jobs in government to pay grades based primarily on the duties and responsibilities each job involves. Problems arise if jobs have incorrect grades, that is, when they have duties and responsibilities inconsistent with grade assignments. Federal jobs at grades higher than those justified by the work they involve, for example, have higher pay than they would with a correct grade assignment. That extra pay could serve merely to close any gap for that job and push federal salaries close to market rates, or it could more than offset any pay gap and leave positions overpaid in relation to jobs outside of government. There is no evidence, however, of systematic errors in grades.[3]

Government Estimates of the Pay Gap Are Consistent with Other Data

Although official estimates may misstate pay gaps in the case of some individual jobs, average gaps calculated by the government appear to be consistent with estimates calculated from private-sector raises (as measured by the full changes in the ECI) and the actual raises granted to federal employees.[4] For the 1977-1994 period, those data show that federal salaries have, in fact, risen more slowly than private-sector salaries. Federal pay raises totaled 91 percent, compared with 139 percent in private industry. (Actual raises for federal employees were well below the comparability level, as defined in law. The ECI index used by CBO covers changes in wages and salaries for white-collar workers, excluding those in sales. That index represents workers most like those in government. The federal pay measure is the average change in the General Schedule. Conceptually, both the federal and private-sector measures used exclude shifts in pay due to mix of occupations.)

The year 1977 is the last one for which employees received the full pay raise necessary to make federal and private-sector salaries comparable as defined by law. Assuming a pay gap of zero in that year, the higher rate of growth in the private sector would mean that by 1994, a pay gap of 25 percent would have separated federal and private salaries (see Figure 1). That number is close to the official

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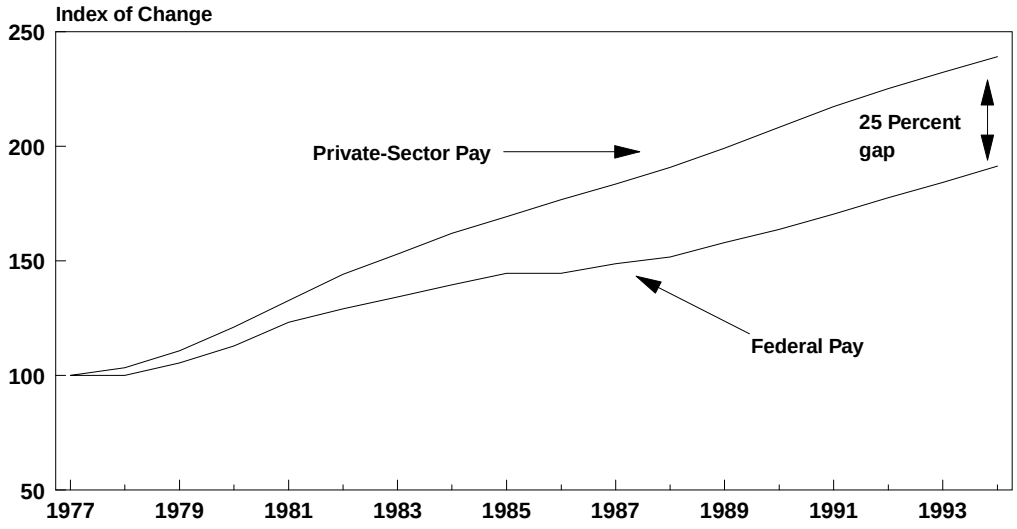
3. Office of Personnel Management, *Federal White-Collar Position Classification Accuracy* (March 1983). See also Congressional Budget Office, *Changing the Classification of Federal White-Collar Jobs*, CBO Paper (July 1991).

4. A similar method of analysis was used in Brent R. Moulton, "A Re-examination of the Federal-Private Wage Differential in the United States," *Journal of Labor Economics*, vol. 8, no. 2 (1990), pp. 270-293.

FIGURE 1. COMPARISON OF CHANGES IN FEDERAL AND PRIVATE-SECTOR PAY



SOURCE: Congressional Budget Office using data provided by the Bureau of Labor Statistics and the Office of Personnel Management.

NOTE: The gap shown is calculated by CBO on the basis of changes in federal pay compared with changes in the employment cost index. The calculated gap compares with an official estimate of 23 percent.

government estimate for that year of 23 percent. The gaps generated in this manner follow the trends in official estimates. In 1990, for example, when the government's estimated pay gap was only 19 percent, the method produces a correspondingly lower gap—17 percent.

The calculated pay gaps track official estimates of the pay gap although the ECI covers many jobs—such as athlete, teacher, and funeral director—that are not well represented in government or are represented in different strengths than in government. Also, it is difficult to know how results were influenced by differences between government and the private sector in rates of promotion and in practices governing pay raises based on length of service. The assumption of a zero pay gap for 1977, moreover, relies on the very governmental pay surveys some people find so questionable. Nevertheless, CBO's calculations may offer some tentative support for official estimates of the pay gap.

THE HUMAN-CAPITAL APPROACH TO COMPARING PAY

Economists have employed an approach that is different from the government's in comparing federal and private-sector salaries. Instead of comparing salaries for similar jobs, the alternative method compares salaries for individuals by taking into account their pay-related characteristics. Those characteristics, called human capital in the economics literature, include, for example, years of education and work experience. Many human-capital studies have suggested that federal employees are overpaid with respect to their level of qualifications. The human-capital results have thus cast doubt on federal comparisons and troubled government officials responsible for federal personnel management.

Although well grounded in traditional economic analysis, human-capital comparisons have been criticized on several bases. Early studies did not meet standard tests of statistical reliability, used very small sample sizes, and had missing variables. In addition, the large wage advantage for federal workers found in early work shrank in subsequent studies as analysts incorporated new variables and refined techniques.

In an effort to determine why the two approaches to pay comparison yield such different results, CBO prepared its own human-capital pay comparison. That comparison improves on early efforts, in particular, by accounting for worker aptitude and job tenure. The results suggest that the government neither overpays nor underpays for a given level of human capital. In other words, the federal government seems to pay workers approximately what they could expect to earn in the private sector.

The Human-Capital Method

Human-capital pay comparisons usually begin with an estimation of what economists call the "wage equation." Using the tools of econometrics, an analyst uses data on individuals' characteristics and pay to estimate how each human-capital characteristic affects rates of pay. The most basic human-capital estimates rely on education and experience (the latter is often approximated by using data on worker age) to explain pay. More sophisticated analyses have employed a variety of procedures to determine whether attributes such as sex, race, location, or firm size have an independent effect on how much workers earn.

One can think of the estimated wage equation as an attempt to quantify the relationship between rates of pay and individual characteristics. For example, a salaried worker may have 12 years of education and five years of experience. Using analysis to estimate the contribution of each trait, on average, to rates of pay, a

human-capital model might indicate that each year of additional education adds $30 to the worker's weekly wage and that each year of extra experience adds $50. If those estimates were based on a simple model, the worker would earn $610 a week ($30 x 12 years + $50 x 5 years).

Wage equations can also incorporate a variable to measure the way in which sector of employment, whether federal or private, affects levels of pay. Thus, estimates can be made of what an individual with a given set of measured characteristics would earn in various sectors. If working for the federal government is associated with a higher salary than working in the private sector, holding other things equal, and if the analysis passes the standard tests of statistical reliability, that suggests that the government, compared with the private sector, overpays for a given level of human capital. Some uncertainty is inherent in any human-capital analysis because no data can perfectly explain the salaries of all individuals. The appendix to this memorandum provides more detail on the particular forms of CBO's human-capital analysis.

The Findings of Earlier Human-Capital Comparisons

Economists have been using human-capital methods to compare federal and private pay for decades. The initial estimates, which were fairly similar to the wage equation described in the foregoing example, suggested a large federal pay advantage. Economist Sharon Smith conducted one of the first comparisons between federal and private pay in 1977, using human-capital techniques.[5] Other analyses also found that if selected variables were held constant, federal workers were overpaid. The size of the estimated pay advantage varied substantially among studies and years but was often around 20 percent. In other words, those studies found that compared with the private sector, a given worker could expect to earn a salary about 20 percent higher working for the government.

More recent human-capital estimates have found somewhat different results. Some of those studies, such as Brent Moulton's, have found a very small or statistically insignificant federal pay advantage.[6] A 1994 study by the General Accounting Office (GAO) using human-capital techniques found a large federal pay

5. Sharon P. Smith, *Equal Pay in the Public Sector: Fact or Fantasy?* (Princeton, N.J.: Princeton University Press, 1977).

6. Moulton, "A Re-examination of the Federal-Private Wage Differential in the United States," pp. 270-293.

disadvantage.[7] What accounts for the different results? In the case of the Moulton study, the researcher added controls for geographic location and occupational group. By contrast, earlier studies ignored whether a worker lived in rural Idaho or urban New York. The large federal pay disadvantage calculated by GAO, which seems to confirm findings using BLS data, compares federal employees with private-sector employees in large firms. It is not clear why GAO's results were so different from those of all other human-capital studies.

The Results of CBO's Comparisons

CBO conducted its analysis in several stages. Each stage used data from the National Longitudinal Survey of Youth. The first stage involved checking whether the database selected was comparable to those used in other studies by using it to try duplicating the results of earlier human-capital comparisons. As discussed above, basic human-capital models have suggested that federal workers are substantially overpaid, given their qualifications in terms of education and experience. Using the simple formulation of those early studies, CBO also finds that federal workers seem overpaid. Further analysis, however, demonstrates that those results are not the final word. The duplication of the earlier studies suggests only that the database used by CBO was reliable and that any differences between CBO's results and those of earlier efforts do not simply reflect differences in data.

The second stage in the analysis involved estimating a more detailed wage equation. Similar efforts by others, as described earlier, have led to much smaller estimates of the federal pay advantage. Consistent with those conclusions, CBO found a smaller federal pay advantage when controlling for such factors as firm size. In fact, when controlling for firm size, the federal pay advantage disappears; that is, from a statistical perspective, one cannot confidently claim that the pay advantage is different from zero.

In the final stage of the analysis, CBO added two additional variables that others had not generally accounted for in human-capital studies: worker aptitude and tenure on the job. Scores on the Armed Forces Qualification Test, which were included in the database, served as the measure of worker aptitude. The data on aptitude allow for an explicit attempt to sort people according to ability.

CBO's analysis included data on job tenure because it seems likely that time spent with a specific firm or job in the government affects wages independently of the effect of general work experience, a factor already incorporated into most

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7. General Accounting Office, *Federal Personnel: Federal/Private Sector Pay Comparisons*, GAO/OCE-95-1 (December 1994).

equations. In addition, job tenure may account for effects previously attributed to firm size. Because workers in both the federal government and large firms are likely to have higher-than-average job tenure, estimates that control for firm size might be inadvertently controlling for job tenure. If so, it is more efficient to control directly for tenure.

CBO performed several tests to check for a federal wage advantage. Each test suggested that, in contrast to many previously reported results, federal employees are neither overpaid nor underpaid based on their human-capital characteristics.

RECONCILING THE RESULTS OF DIFFERENT PAY COMPARISONS

The expanded human-capital analysis prepared by CBO significantly reduces the difference in results between the human-capital approach to comparing pay and the one used in federal pay-setting, but differences remain. Why, when pay comparisons involve similar jobs, do they show that federal employees are underpaid in relation to employees in the private sector, but when they involve similar salary-related employee characteristics they show that federal workers are paid about the same as those in the private sector? One possible answer is that the federal government and the private sector utilize workers in different ways.

Explaining Different Results

Much of the debate about pay comparisons has revolved around the assumption that the results of only one of the two approaches described in this report can be right. But both approaches may be correct.[8] How then does one reconcile the apparently contradictory results? The possibility explored here is that the federal government places employees with a given set of characteristics in higher-level positions than does the private sector.

A hypothetical example may help make the point. An entry-level accountant may earn $35,000 a year in a private firm. If the federal government employs that person at the same salary to do senior-level accounting, a comparison of jobs would show that the government underpays; its salary for senior-level accountants, $35,000, is only what the private sector pays junior accountants. A comparison of individuals with the same experience and other job-related characteristics would, on the other hand, show that the government pays about the same as the private sector; the

8. See also Robert W. Hartman, *Pay and Pensions for Federal Workers* (Washington, D.C.: Brookings Institution, 1983).

accountant would earn $35,000 whether employed in government or in private industry. Both studies would yield correct but different results. What appears on the surface as a contradiction is reconciled by the observation that the government would utilize the worker in question in a higher-ranking position than would private industry.

How Federal Employees Can Become Placed in Relatively Higher Positions

How can the government place employees in higher-level positions than can firms outside of government? In part, the practice may reflect the relatively low pay that the government offers for some jobs, consistent with the findings of pay surveys using BLS data. Federal managers may have to use employees with relatively less human capital for some jobs, because uncompetitive federal salaries will not allow them to attract the same kind of experience, education, and other qualities that private firms get. In the case of the hypothetical accountant, for example, the government must use for senior-level work an employee that the private sector would consider only for a junior-level position.

Federal managers may also promote employees to positions for which a private firm would not consider them in order to raise pay and make salaries more competitive. In the case of the hypothetical federal, senior-level accountant, after experience and training in federal service, he or she might qualify for senior-level work outside of government at much higher pay. In such an instance a federal manager may attempt to raise the accountant's pay grade in order to make the federal salary more competitive and retain the employee in public service. If so, an employee that the private sector might consider a senior-level accountant would hold an even higher position in government for no more money. Indeed, the government employs a relatively high portion of federal workers at the upper pay grades. In 1995, for example, one-half of all white-collar employees held jobs at the top five pay grades of the 15-grade General Schedule.

In raising grades to make federal pay more competitive, federal managers do not necessarily create overgraded employees—meaning those whose positions do not involve the full range of responsibilities associated with their pay grade. (As described earlier, available evidence shows no widespread overgrading.) Employees may actually hold all the duties and responsibilities appropriate to the new grade, although the quality of work may suffer.

Human-capital pay comparisons add evidence indicating that for the type of person the government attracts to federal service, it neither over nor underpays. Taken together, the two methods of pay comparison suggest that the government gets

less human capital for some jobs because it pays less for those jobs, but that for what it does get, it pays about the right amount.

Evidence Suggests That the Government Uses Workers in Higher-Ranking Jobs

One of the few studies examining differences in how the government and the private sector utilize workers offers some support for CBO's hypothesis.[9] That analysis used data specially commissioned as part of BLS pay surveys, along with data from OPM and the Current Population Survey, to identify differences between the federal government and the private sector in the characteristics of workers who held the same type of job. Holding constant such worker characteristics as education, experience, and tenure, the study found that the federal government puts workers at higher levels of responsibility than would private firms.

The analysis quantifies the extent to which the federal government uses workers at higher levels. For example, the study found that 52 percent of private-sector employees in the occupation of purchasing clerk are employed at one level of responsibility lower than comparable federal workers outside of Washington, D.C. The study found that, on average, 77 percent of private employees would have to be promoted one level to reach the average level of responsibility of similar workers in federal service. The analysis also offers evidence that the pattern occurs in the two ways described previously: the government hires some employees at initially higher levels than would the private sector and promotes others into such positions.

A 1984 analysis by CBO also offers evidence that supports the view expressed here: that the government compensates for low salaries by utilizing employees at higher grade levels.[10] That earlier study compared the job rank and salary distributions of federal employees with the distributions of private-sector employees in similar jobs. The comparisons covered selected jobs in a variety of types of work, including personnel administration, engineering, and finance. BLS's white-collar pay surveys served as the source of data on private-sector salaries and job rankings. The Congressional Budget Office's comparisons of job rankings for the selected jobs showed that compared with the private sector, the federal government had a disproportionate share of its employees at the upper ranks. The jobs in the ranks that CBO compared carried similar duties and responsibilities. Given the

9. Melissa Famulari, "Maintaining a Labor Force Under Wage Controls: The Case of the Federal Government" (working paper, University of Texas at Austin, 1997). That study also shows that the different private-sector data used in human-capital studies and federal pay comparisons contribute to different results.

10. Congressional Budget Office, *Reducing Grades of the General Schedule Work Force* (September 1984).

distribution of employees by rank, one might expect a similarly uneven federal and private-sector salary distribution. Using data for the same employees and jobs, however, CBO found similar salary distributions. Although federal employees had higher rankings, they did not appear to have higher pay.

Recruitment and Retention

Critics of federal pay practices have raised a number of concerns that bear on the hypothesis presented in this memorandum. They have asked, for example, how the government attracts employees to public service and how it keeps them with such success, judging by low rates of resignation, if pay for federal jobs is so low in relation to nonfederal levels. One might even ask how the government recruits and retains employees when it pays less and its jobs carry more duties and responsibilities.

Recruitment to Federal Service. Why would anyone take a federal job involving more responsibility and relatively less pay? Analysis suggests that although salary continues to play the key role in decisions to join and stay in federal service—especially among the best and the brightest—it is not the only consideration.[11] Prospective employees, for example, may find the federal benefits package attractive. They may also be drawn by considerations other than money: for example, the desire to serve the public. In the past, superior job security has attracted many people to federal employment. The very challenge of more responsibility may appeal to many as well.

But the concept that factors other than pay may help federal managers in their recruiting efforts tells one little about the type of employee who ends up in public service. Aspects of federal service aside from pay may help the government get more for less, but another outcome, consistent with this analysis, is that the government still accepts less human capital for some jobs.

Explaining Low Federal Quit Rates. Some analysts claim that the rate at which federal employees quit their jobs is low compared with that of private employees, and therefore federal pay cannot be as out of balance with the private sector as BLS data suggest. (Quits are defined here as voluntary separations from federal employment for reasons other than retirement.) Data from OPM show that about 2.6 percent of the federal white-collar workforce quit in 1995. Although no one has made

11. General Accounting Office, *How Federal Employees View Government as a Place to Work*, GAO/GGD 92-91 (June 1992), and *Comparison of Applicants Who Accepted or Declined Federal Job Offers*, GAO/GGD 92-61 BR (March 1992); Merit Systems Protection Board, *Why Are Employees Leaving the Federal Government?* (May 1990).

comparisons of federal and nonfederal quits recently, studies from the early 1980s do show relatively low federal quit rates.[12]

Studies on the subject over the years offer a number of explanations for the low rates. Those studies point to factors other than pay as playing a significant role in keeping the frequency of federal quits low. A 1983 study, for example, showed that the large size of the federal government can help explain low quit rates.[13] Large organizations such as government may offer employees, through internal transfers, the opportunity for change, variety, and advancement that employees in small firms could only achieve by changing employers. Large firms and government may also attract employees who value the stability. Such employees would be expected, all else being equal, to have lower quit rates. A 1987 study concluded that federal retirement benefits help explain low federal quit rates.[14] According to that analysis, the large retirement penalties imposed on some federal employees who quit early and the large portion of compensation that retirement represents encourage employees to stay in federal service.

The age of the federal workforce may also help explain the low rates. Studies of quits consistently show that younger employees leave firms more often than older workers. The federal government tends to hire older employees—the average age of a new hire in 1995 was 36—and on average the federal workforce is about five years older than the nonfederal workforce.

The studies of federal quits cited above suggest that low pay need not be accompanied by high turnover. They also indicate the difficulty of using measures of the frequency with which employees leave as an indicator of the adequacy of pay. If, for example, the opportunities for career development and change offered by the size and diversity of government help keep employees in government, then adjusting pay rates would not necessarily change the rate at which federal employees quit over the long run. A pay cut might cause some short-term increases among those for whom federal service no longer paid off, but there is no reason to assume that new federal hires would be more or less likely to quit over time than the people they replace. What would probably change with changes in pay, however, is the human capital attracted to public service. That is exactly what the analysis described in this report suggests is happening with the federal workforce.

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12. See, for example, James Long, "Are Government Workers Overpaid? Alternative Evidence," *Journal of Human Resources*, vol. 17, no. 1 (1982).

13. Kathleen C. Utgoff, "Compensation Levels and Quit Rates in the Public Sector," *Journal of Human Resources*, vol. 18, no. 3 (1983).

14. Richard A. Ippolito, "Why Federal Workers Don't Quit," *Journal of Human Resources*, vol. 22, no. 2 (1987).

CONCLUSION

One explanation of the contrasting results of different pay comparisons suggests that the relatively low pay that the federal government offers for some jobs may be leading federal managers to accept less experience, education, and other human-capital characteristics for those jobs than do private-sector managers. The government, however, appears to pay people it is able to recruit about the going rate by the standards of private-sector employees.

APPENDIX: DETAILS OF THE CBO ANALYSIS

This appendix presents details of the human-capital analysis performed by the Congressional Budget Office (CBO). All of the work relied on data from the National Longitudinal Survey of Youth. The survey has followed a random sample of people since 1979, reinterviewing them every year to obtain a panel of data among people over time. The survey covers a wide range of topics; employment is just one of many subject areas revisited on a yearly basis. Those interviewed were between ages 14 and 22 at the time of the original interview.[1]

Human-Capital Analysis

The first model estimated by CBO takes the form:

$$\ln(w_i) = a + bX_i + \epsilon_i$$

where the log of the wage is a function of a constant, a vector X of individual characteristics, and a random, normally distributed error term of mean 0. In this formulation, X includes only education, experience, experience squared, dummy variables for race and sex, and a dummy variable indicating whether the worker is a federal employee. The dependent variable in this case is the log of the weekly salary.[2] Experience is measured as age minus education minus 6. The results of the estimation are presented in Table A-1. The errors were tested for heteroskedasticity (whether error terms in a statistical model have unequal variances), and the standard errors were corrected using White's covariance matrix.

Within the framework of that simple human-capital model, CBO was able to confirm the results of early studies and note, consistent with those studies, a large, statistically significant federal wage premium. Because the dependent variable is the natural log of earnings (and not actual earnings), in order to construct the size of the premium one must transform the federal dummy coefficient by subtracting 1 from

1. Of course, that inherently creates a sample of relatively young employees. But that is a sacrifice worth making because of the richness of the data set in other respects. In addition, dealing primarily with younger employees should limit the problems caused by differences in retirement benefits, particularly in the federal government where generous retirement benefits may add incentive to stay on the job as tenure increases.

2. Additional regressions used the log of the hourly salary with similar results. Therefore, in order to reduce the chance for reporting errors, weekly salary was used in all subsequent estimations.

TABLE A-1. A BASIC HUMAN-CAPITAL MODEL (Standard error in parentheses)

Independent Variable[a]	Coefficients
Constant	9.58[b] (0.19)
Education	0.09[b] (0.006)
Experience	0.3×10^{-2} (0.02)
Experience Squared	0.2×10^{-3} (0.8×10^{-3})
Female	-0.32[b] (0.02)
Minority	-0.24[b] (0.02)
Female Minority	0.12[b] (0.04)
Federal Employee	0.18[b] (0.04)
R^2	0.25
Number of Observations	2,471

SOURCE: Congressional Budget Office.

a. The dependent variable is the log of the weekly salary.

b. Statistically significant at the .05 level or greater.

its antilog. That yields an estimated pay premium of 19.4 percent, which is within the range of estimates reported in the human-capital studies.[3]

Techniques of subsequent studies went beyond the basic human-capital approach. For example, Gyourko and Tracy tried to account for unobserved worker "preferences" (that is, preference for job security, advancement, and initiative) by using a two-stage procedure that implicitly accounts for such tastes.[4] Those studies employed various modeling techniques that attempted to account properly for the fact that sector of employment is not necessarily a random event. Endogenous switching models and other multistage estimation techniques can properly account for such problems. The basic result that federal employees seem overpaid remains a common thread among the studies cited in this section.

For the sake of comparison, Table A-2 presents the results for a CBO estimate that included the effects of firm size. That equation represents a combination of the approaches used in the studies mentioned above. Indicator variables were included for four firm sizes, with the fifth classification (over 1,000 employees) left out of the equation, as in the 1994 General Accounting Office (GAO) study.[5] Also, equations included indicators for state and local government employees, so the federal dummy compared federal workers only with workers at large private firms. Geographic-region variables were also included, in addition to broad occupational controls (managerial, administrative, technical workers, and blue-collar workers). The results were corrected for heteroskedasticity.

The analysis shows that, as in previous studies, the estimated federal wage advantage shrinks significantly after controlling for firm size and geography. The estimated premium is only 4.5 percent and not statistically significant at any conventional level. (Without occupational, geographic, and firm-size controls, the estimated wage premium using the same data was over 19 percent). In addition, the analysis demonstrates the usual firm size results—in particular, larger firms pay higher wages. There is no universally accepted explanation for that phenomenon, but the effect has been persistent in most estimated wage equations.

Although including firm size in its analysis eliminates the estimated wage premium, CBO wanted to test more thoroughly the proposition that the federal

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3. The coefficient on the federal dummy variable is 0.17751. Exp (0.17751) - 1 = 1.194 - 1 = 0.194, or 19.4 percent.

4. Joseph Gyourko and Joseph Tracy, "An Analysis of Public and Private-Sector Wages Allowing for Endogenous Choices of Both Government and Union Status," *Journal of Labor Economics*, vol. 6, no. 2 (1988), pp. 229-253.

5. The sizes are 1-24, 25-99, 100-499, and 500-999 employees.

TABLE A-2. A HUMAN-CAPITAL ESTIMATE CONTROLLING FOR FIRM SIZE AND OTHER FACTORS (Standard error in parentheses)

Independent Variable[a]	Coefficients
Constant	10.09[b] (0.18)
Education	0.05[b] (0.006)
Experience	-0.19×10^{-2} (0.02)
Experience Squared	0.26×10^{-3} (0.71×10^{-3})
Female	-0.31[b] (0.02)
Minority	-0.11[b] (0.03)
Female Minority	0.08[b] (0.03)
Northeast	0.01 (0.03)
North Central	-0.13[b] (0.03)
South	-0.16[b] (0.02)
Managerial/Professional Worker	0.30[b] (0.03)
Technical Worker	0.22[b] (0.04)
Administrative/Clerical Worker	0.15[b] (0.03)
Blue-Collar Worker	0.13[b] (0.03)

(Continued)

TABLE A-2. CONTINUED

Independent Variable[a]	Coefficients
Firm Size Under 25	-0.22[b] (0.03)
Firm Size 25-99	-0.13[b] (0.03)
Firm Size 100-499	-0.04 (0.03)
Firm Size 500-999	-0.02 (0.04)
Federal Government Worker	0.04 (0.05)
State Government Worker	-0.14[b] (0.04)
Local Government Worker	-0.09[b] (0.04)
R^2	0.37
Number of Observations	2,471

SOURCE: Congressional Budget Office.

a. The dependent variable is the log of the weekly salary.

b. Statistically significant at the .05 level or greater.

government does not provide a wage different than that paid by most other employers. The next section presents a basic model that does not rely on firm-size effects.

A Model of Federal Wage Determination

Assume that for the private sector, a variant of the typical human-capital model holds

$$pw^i_j = f(X^i, Z_j, M)$$

where the private-sector wage *pw* of individual *i* working at job *j* depends on *X*, a vector of human-capital characteristics such as education and experience; *Z*, a vector characteristics such as location and qualifications; and *M*, a vector of market conditions. Further, assume that

$$pw^i_j = pw^k_j \quad \text{if and only if } X^i = X^k,$$

and that

$$pw^i_j = pw^i_l \quad \text{if and only if } Z_j = Z_l.$$

In other words, individuals with identical human capital earn the same private-sector wage for the same job, and an individual earns the same wage at two jobs that have identical characteristics.

Next, consider what determines the pay for a federal job:

$$fw_j = g(pw_j)$$

where fw_j is the federal pay for job *j* and *g* is a function of the wages paid in the private sector for job *j*. For example, *g* might simply be the mean wage for job *j*, so that

$$fw_j = r_j \mu_j$$

where μ_j is the mean. The fact that the subscripts are identical means that, by definition, the private and federal jobs are identical in all respects except for the signer of the employee's paycheck.

The difference between the wages set in the federal and private sectors is that in the case of the federal sector, CBO assumes that

$$fw^i_j = fw^k_j = fw_j \; \forall \; i,k$$

In other words, for federal workers pay is only a function of position, whereas in the private sector pay within a position may be adjusted for human-capital (or other) considerations. Thus, in the simple model of federal wage determination for job *j*,

$$fw^i = g(X^i, Z_j, M)$$

where *g* is assumed to differ from *f* in some way. Now, assuming a more specific form for *g* that incorporates both statutory federal pay policy and the fact that managers might have some discretion in determining the position of their employees:

(1) $$fw^i = g(X^i, Z_j, M) = rf(X^i, Z_j, M) + a(X^i, Z_j, M)$$

The coefficient *r* is to be interpreted as the ratio of federal pay to private pay, and *a* is an adjustment factor that may be employed by the worker's supervisor in order to adjust wages. The ratio *r* is not a choice variable in this equation—instead, it is a parameter that reflects what federal pay for a worker would be, in relation to the private sector, without any adjustments in the person's position or responsibilities in the federal sector. Because *r* is set by law or policy and pay is purely a function of position, it is assumed that the adjustment factor is the only way for supervisors to adjust pay; it is included to account for practices such as "grade inflation," in which supervisors promote people to higher classifications for the purpose of increasing pay and retaining employees. The adjustment factor should also depend on both human-capital characteristics and job characteristics. A ratio of 1 and an adjustment factor of zero would imply that the federal worker earns exactly what he or she would earn in the private sector. Federal law permits r_j to equal 1; however, studies by the Bureau of Labor Statistics (BLS) have shown that this is almost never the case—according to BLS, in fact r_j is generally less than 1.

Testing the Model

The model proposes that for private workers,

(2) $$pw^i = f(X^i, Z_j, M)$$

while for federal workers,

(3) $$fw^i = rf(X^i, Z_j, M) + a(X^i, Z_j, M)$$

where *r* is the ratio of federal to private wages and *a* is an adjustment factor that can vary for individuals, jobs, and locations. Thus, the wage of individual *i* can be expressed as follows:

(4) $$w^i = f(X^i, Z_j, M) + (fed)[(r - 1)f(X^i, Z_j, M) + a(X^i, Z_j, M)]$$

where (fed) indicates whether or not *i* is a federal employee. If *a* does not apply or has no effect, then if *r* is less than 1 there is a penalty for federal employment, and if *r* equals 1 federal workers earn the same wage as private workers. One can assume, based on BLS surveys, that *r* is less than 1. If one also assumes that *a* and *f* have simple (that is, log linear) functional forms, estimation of equation (4) becomes a matter of choosing *X*, *Z*, and *M* and then interacting all variables with a federal dummy. Each coefficient on the interacted variables will then represent the combined effect of *r* and *a*, the adjustment factor; it is not possible to distinguish between the two effects, although CBO assumes that *r* is less than 1, so it may make inferences about the relative sign and size of *a*. CBO is interested in determining whether federal employees earn what they would earn in the private sector. Thus, it can test whether the coefficients on the interacted terms are all jointly equal to zero—a basic F-test.

Estimating the CBO Model

The National Longitudinal Study of Youth (NLSY) data set contains variables that are rarely available—for example, an aptitude measure and job tenure data.[6] Job tenure seems to be an especially important variable that has been left out of previous analyses of the federal wage premium. Job tenure has been shown to be correlated with increased wages by previous researchers. Robert Topel offers very strong evidence that the relationship between seniority and wages is important.[7] That result, coupled with traditionally low government turnover rates (implying an abnormally high average tenure rate for federal employees), suggests that the wage premium found in other studies could easily be picking up tenure effects that are otherwise unaccounted for. The lower turnover rate in large firms offers corroborating evidence for that theory. As shown in the previous section, the wage premium all but disappears when accounting for firm size. In fact, estimates that control for firm size might be inadvertently controlling for job tenure. If so, it is more efficient to control for tenure directly. That gives strong reason to believe that tenure effects ought to be included in the wage estimation.

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6. James N. Brown and Audrey Light, "Interpreting Panel Data on Job Tenure," *Journal of Labor Economics*, vol. 10, no. 3 (1992), pp. 219-257. Brown and Light present evidence that the data on job tenure are quite reliable; reliability has been a problem in several other measures of tenure.

7. See John Garen, "Empirical Studies of the Job Matching Hypothesis," in Ronald G. Ehrenberg, ed., *Research in Labor Economics*, vol. 9 (Greenwich, Conn.: JAI Press, 1988), pp. 187-224; and Robert Topel, "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, vol. 99, no. 1 (1991), pp. 145-176.

In order to test whether federal employees earn what they would earn in the private sector, CBO used the NLSY data to estimate two versions of equation (4). The dependent variable is the log of the weekly salary. Independent variables in both estimations included the usual human-capital explanatory variables, that is, education, experience, experience squared, controls for race and sex, and geographic dummies. In addition, the Armed Forces Qualification Test (AFQT) percentile score served as an aptitude measure, dummy variables controlled for the local unemployment rate and union status, a job tenure variable and tenure squared were included, and broad occupational controls were entered into both estimations.[8] In the first estimation, all of the coefficients on the federal variables were restricted to equaling zero. The second equation estimated included a dummy variable for federal employees, as well as a full set of interaction variables between the federal dummy and the other explanatory variables. The key results of both estimations (with standard errors estimated using White's heteroskedasticity consistent covariance matrix) are presented in Table A-3.

The main goal of this estimation was to test whether the federal interaction variables are jointly significant. An F-test comparing the restricted and unrestricted models indicates that CBO cannot reject the hypothesis that all the federal variables are equal to zero at any reasonable significance level—the F statistic is only 1.29 for the hypothesis that all federal coefficients equal zero. That confirms the more recent human-capital estimates that have suggested little or no overall wage premium for federal employees, but does not go as far as earlier GAO work that found a statistically significant pay gap. In fact, the coefficient on the federal dummy is large and negative, but the standard error is also large.[9]

The AFQT, tenure, tenure squared, and union-status effects are large and statistically significant in the directions expected. When aptitude, tenure, and union status are accounted for, the same data that show a large federal wage premium without those controls show no such effect with the controls in place. That confirms the hypothesis that the federal wage premiums estimated in the past might really indicate that federal workers have higher tenure or higher AFQT scores than their

8. The controls for the unemployment rate were dummy variables for ranges of the unemployment rate in the metropolitan statistical areas of residence. The occupational categories were managerial/professional, administrative/clerical, technical, and blue collar. The results were not sensitive to the exclusion of the occupational controls; given their significance, they were retained.

9. Because of the size of the federal government, a full set of interaction variables between firm size and the federal government is not possible. However, the results do not change when dummies that control for firm size are included and not interacted with the federal dummy.

TABLE A-3. HUMAN-CAPITAL ESTIMATES WITH TENURE, UNION, AND APTITUDE MEASURES (Standard error in parentheses)

Independent Variable[a]	With No Federal Effects	With Federal Effects
Constant	9.97[b] (0.17)	10.04[b] (0.18)
Education	0.04[b] (0.006)	0.04[b] (0.006)
Experience	-0.2×10^{-2} (0.02)	-0.2×10^{-2} (0.02)
Experience Squared	0.8×10^{-3} (0.6×10^{-3})	0.8×10^{-3} (0.7×10^{-3})
Female	-0.29[b] (0.02)	-0.29[b] (0.02)
Minority	-0.08[b] (0.03)	-0.09[b] (0.03)
Female Minority	0.05 (0.03)	0.05 (0.03)
Tenure	0.05[b] (0.006)	0.05[b] (0.007)
Tenure Squared	-0.002[b] (0.4×10^{-3})	-0.002[b] (0.5×10^{-3})
Union Status	0.18[b] (0.02)	0.17[b] (0.02)
Aptitude Test Score	0.004[b] (0.4×10^{-3})	0.004[b] (0.4×10^{-3})
Federal Worker	n.a.	-1.39 (1.04)
Federal Interacted with Tenure	n.a.	0.02 (0.03)

(Continued)

TABLE A-3. CONTINUED

Independent Variable[a]	With No Federal Effects	With Federal Effects
Federal Interacted with Aptitude Test Score	n.a.	0.002 (0.003)
Federal Interacted with Union Status	n.a.	0.14 (0.09)
R^2	0.411	0.418
Number of Observations	2,471	2,471

SOURCE: Congressional Budget Office.

NOTE: n.a. = not applicable.

a. The dependent variable is the log of the weekly salary.

b. Statistically significant at the .05 level or greater.

private-sector counterparts.[10] The data do not suggest that those traits are rewarded any more or less in the public sector than in the private sector. Accounting for the federal status of workers does little or nothing to improve the fit of the fairly detailed wage model CBO has estimated.

A note is in order on the potential endogeneity of some of the variables. It is reasonable to expect that certain variables—in particular, the job tenure, federal employee, and union variables—are endogenous. Because of the extensive interaction terms that are necessary to test for the total effect of federal employment, however, it is difficult to find enough good instruments to make estimates of instrumental variables worthwhile. In regressions treating only tenure endogenously, the results were similar to those reported here.[11]

10. See Richard A. Ippolito, "Why Federal Workers Don't Quit," *Journal of Human Resources*, vol. 22, no. 2 (1987), pp. 281-299; and Neal Masia, "The Federal Government in the Labor Market: What Does It Pay For, and What Does It Get?" (draft, Congressional Budget Office, 1996).

11. The regressions are identified using data on fringe benefits.