United States General Accounting Office

GAO

Report to Congressional Committees

December 1994

FEDERAL PERSONNEL

Federal/Private Sector Pay Comparisons

GAO/OCE-95-1

GAO

United States
General Accounting Office
Washington, D.C. 20548

B-256047

December 14, 1994

The Honorable John Glenn
Chairman
The Honorable William V. Roth, Jr.
Ranking Minority Member
Committee on Governmental Affairs
United States Senate

The Honorable William L. Clay
Chairman
The Honorable John T. Myers
Ranking Minority Member
Committee on Post Office and Civil Service
House of Representatives

This report presents the results of our review of the methodologies underlying various estimates of the differences between federal white-collar pay and the salaries of similar workers in private industry. This report was prepared pursuant to our basic statutory authority. We are sending it to you because of your committee's responsibility for federal personnel matters.

We are sending copies of this report to other interested Members of Congress, as well as the President's Pay Agent (the Secretary of Labor and the Directors of the Office of Personnel Management and of the Office of Management and Budget). Copies will also be made available to other interested parties upon request.

Appendix VIII lists the major contributors to this report. Please contact me at (202) 512-6209 if you have any questions concerning this report.

James R. White

James R. White
Acting Chief Economist

Executive Summary

Purpose

The federal government's official surveys of the pay—wages and salaries—of federal and private sector employees have indicated that federal pay has lagged behind prevailing levels for comparable jobs in private enterprise and that the pay gap has grown over the last 2 decades.

However, these official estimates of the pay gap have been subjected to criticism in both academic studies and media accounts. Critics argue that the official methodology for performing pay comparisons is defective. They claim that data from sources other than the official surveys, when analyzed using different methodologies, lead to a different conclusion: that federal pay levels are higher than prevailing levels for employees with comparable characteristics, such as education and work experience, in private enterprises.

In view of these opposing conclusions, GAO identified and analyzed possible explanations for the discrepancy between official estimates of the federal private pay gap and those of the critics. Because federal personnel management policy includes factors that are beyond the scope of this report, such as the level of fringe benefits and judgments concerning the desired quality of the federal workforce, GAO did not reach conclusions about the appropriateness of comparability estimates or the level of federal pay.

Background

GAO analyzed data from 1978 through 1987, the most recent period for which suitable data were available. For that period, applicable federal laws required that federal pay be comparable with pay of private enterprise for the same level of work. The National Survey of Professional, Administrative, Technical, and Clerical Pay (PATC), which was conducted by the Bureau of Labor Statistics (BLS), collected data on annual pay for jobs in private enterprise, which were then compared with pay data for corresponding jobs in each grade of the general schedule in the federal civil service (a position comparison approach). PATC data formed the basis for official estimates of the pay gap. Over the years, pay gap estimates based on PATC data have consistently shown that employees in the federal government are paid less than those in the private sector.

In distinct contrast to the PATC-based results, a set of academic studies based on a human capital approach (which compares the earnings of individuals with similar personal characteristics, such as years of education, rather than similar occupations) has consistently shown that federal employees are paid more than their private sector counterparts.

Results in Brief

GAO's review of academic studies identified two factors that might explain differences between the human capital and official estimates of the pay gap.

First, official pay comparisons compare the pay of federal employees to that of employees of predominantly large employers in similar occupations, while the human capital studies compare the pay of federal employees to that of employees of nonfederal employers of all sizes. Because employees of small private employers tend to be paid less than their counterparts in large firms, the choice of private sector comparison group can affect estimates of the pay gap. When GAO adjusted human capital estimates of the federal private pay gap for the effect of employer size on pay, the discrepancy between human capital and official estimates of the pay gap was decreased.

Second, official estimates compare pay for employees in the same occupation and work level, ignoring such personal characteristics as race and gender. By contrast, academic studies implicitly compare federal employees to private sector employees of the same age, education, race, and gender, while largely ignoring occupation. Because privately employed women and minorities tend to be paid less than their counterparts in the federal sector, after adjusting for education and work experience, the choice of comparison group can affect estimates of the pay gap. When GAO adjusted human capital estimates of the pay gap so that all federal employees were compared to private sector white males, rather than to all private sector employees, the discrepancy between the two estimates also decreased.

The combined effect of these two adjustments produced human capital estimates that are similar to the official estimates. GAO did not reach conclusions about the appropriateness of the adjustments. Because federal personnel management policy includes important factors that are beyond the scope of this report, and which may be influenced by the level of pay, our analysis cannot by itself be used to judge the appropriateness of comparability estimates or the level of federal pay.

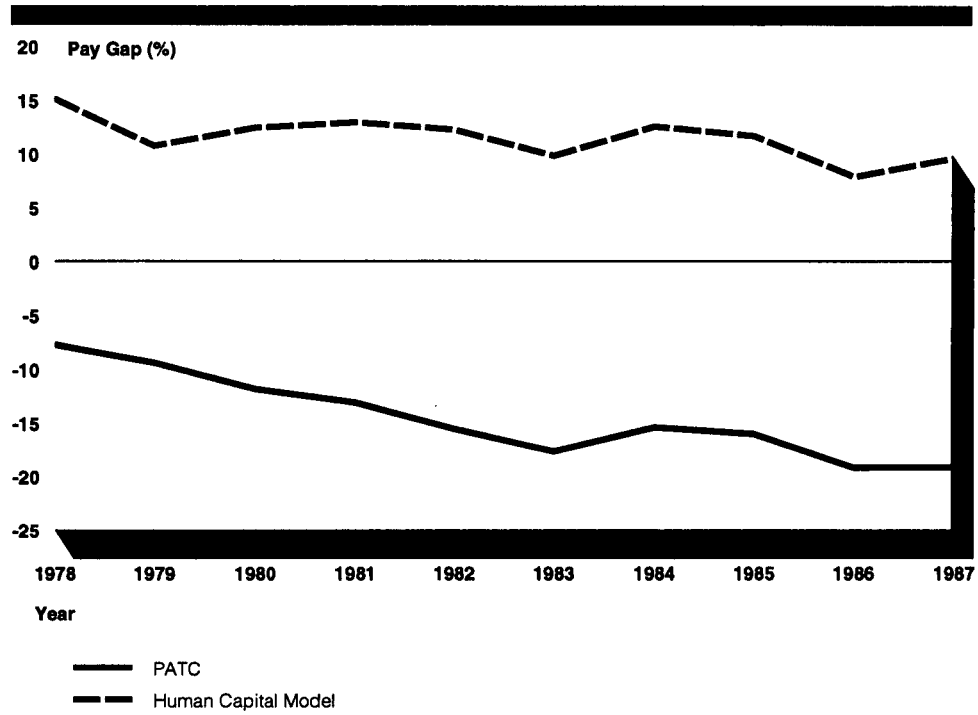
GAO's analysis shows the importance of considering the effects of employer size and race and gender on both official and human capital estimates of the gap between federal and private pay. The official position comparison estimates and human capital estimates are based on different methodologies, both of which have limitations—neither method is clearly superior.

GAO's Analysis

Human Capital Model Estimates of Pay Gap Differ From Official Estimates

GAO analyzed data from the Current Population Survey (CPS), the principal data source used by analysts who have produced human capital pay comparisons. GAO's analysis of the CPS data, using standard econometric techniques for comparisons based on the human capital method (including standard specifications for education, work experience, race, and gender), showed that federal employees were consistently paid more than their private sector counterparts with similar personal characteristics. The estimated size of the pay premium ranged from 7 to 15 percent over this period. This finding is broadly consistent with the findings of the numerous human capital analysts whose research GAO reviewed for this report. The official pay gap estimates of the President's Pay Agent, based on data from PATC for this period, yielded the opposite conclusion, namely, that federal employees were paid less than their private sector counterparts with similar jobs. (See fig. 1.)

Figure 1: The Pay Gap as a Percentage of Private Sector Pay



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

The Effect of Employer Size on Pay Gap Estimates

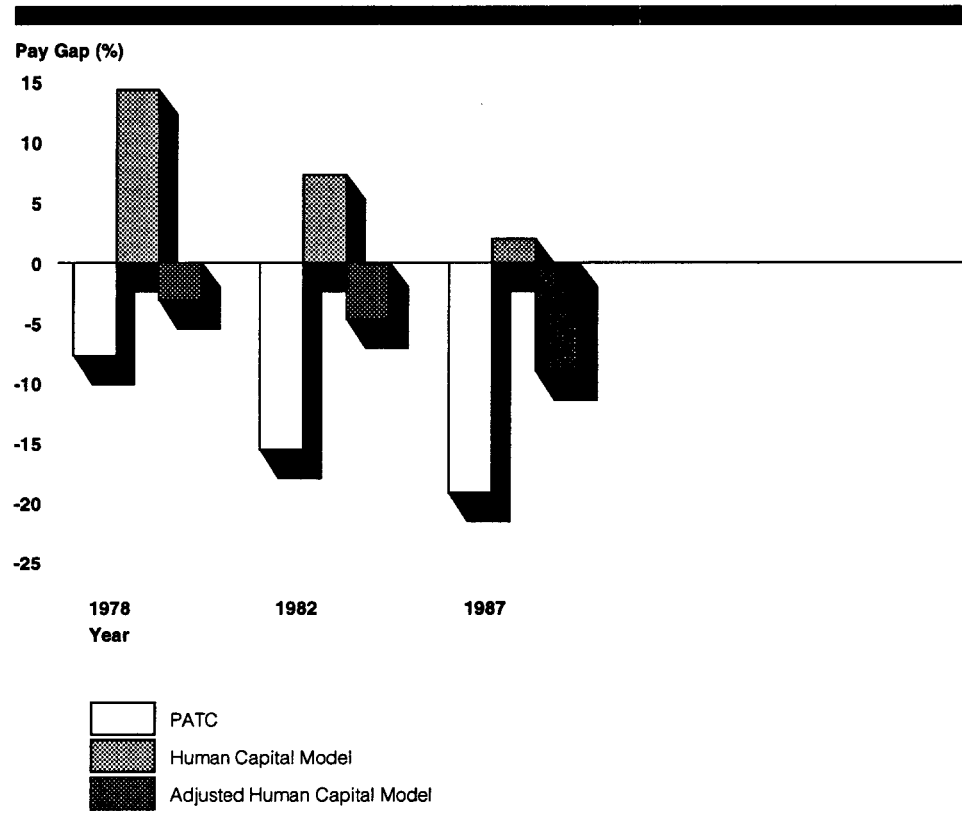
CPS provided information on employer size at three points in the period of GAO's analysis: 1978, 1982, and 1987. For these 3 years, GAO adjusted the standard human capital model to account for the relatively high pay of employees of large private employers.

Even after allowing for employee characteristics, numerous studies have found that larger employers pay higher wages and salaries than smaller employers. Further, surveys that compare pay on a position-by-position basis, such as PATC, have a higher percentage of large-firm employees than do CPS data, which are commonly used for human capital estimates of the pay gap. The specialization and distinct level of responsibility associated with many federal jobs mean that BLS is more likely to find matches in larger organizations. These factors could cause human capital estimates of the pay gap to differ from official estimates.

When GAO compared federal white-collar pay to that of employees of large private employers, it was able to demonstrate the effect of employer size

on human capital estimates of the pay gap. The effect of relatively high pay at large private employers is substantial. However, the effect of this factor alone is less than the difference between estimates of the pay gap. (See fig. 2.)

Figure 2: The Pay Gap Adjusted for Employer Size



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

The Effect of Federal Pay of Women and Minorities on Pay Gap Estimates

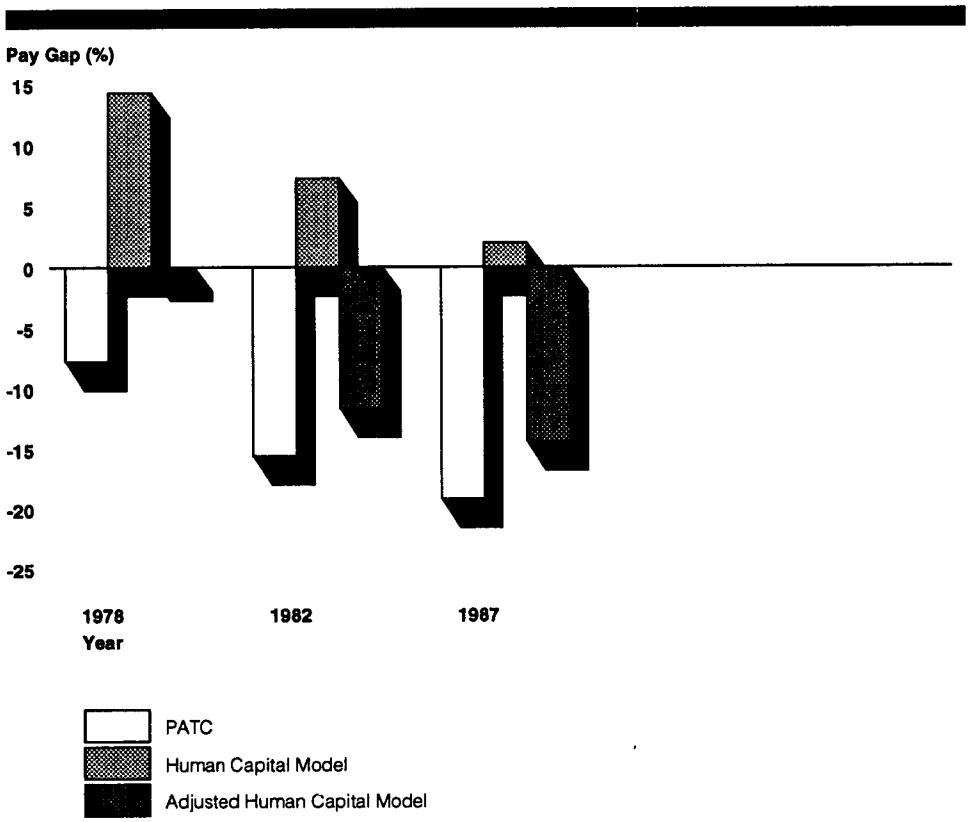
In addition, GAO adjusted the standard human capital model to reflect the federal pay of women and minorities. Federally employed women and minorities earn relatively more than privately employed women and minorities, at least in part because of occupational differences. One way human capital estimates of the pay gap can be computed compares federal workers to all private sector workers, controlling for education, work experience, race, and gender in a standard fashion. GAO followed this procedure in estimating the standard human capital model.

GAO also analyzed an alternative method of computing the pay gap in which the pay of federal white males, women, and minorities is compared to the pay of private sector white males. The choice of a private sector comparison group involves implicit assumptions about the reasons for race- and gender-based differences in pay within the private sector. By comparing federal employees to all private sector employees the analyst allows the lower pay of private sector women and minorities, relative to private sector white males, to influence the size of the pay gap. Such a comparison implicitly assumes that private sector pay differences by race and gender are caused by unobserved productivity differences that are not necessarily related to education and work experience. By comparing all federal employees to private sector white males the analyst does not allow the lower pay of private sector women and minorities, relative to private sector white males, to influence the size of the pay gap. Such a comparison implicitly assumes that private sector pay differences by race and gender are caused by labor market discrimination.

To the extent that both productivity differences and labor market discrimination influence private sector race- and gender-specific pay differences, this alternative represents an upper limit on the effect of private sector labor market discrimination on human capital estimates of the pay gap. Discrimination can take other forms. For example, productivity may be influenced by previous discrimination in education. GAO did not reach any conclusions about the appropriateness of either method of adjusting for race and gender; the analysis shows the significance of the choice.

The effect of using private sector white males as the comparison group, as shown in figure 3, is substantial. Again, the effect of this factor alone is less than the difference between estimates of the pay gap.

Figure 3: The Pay Gap Adjusted for the Federal Pay of Women and Minorities

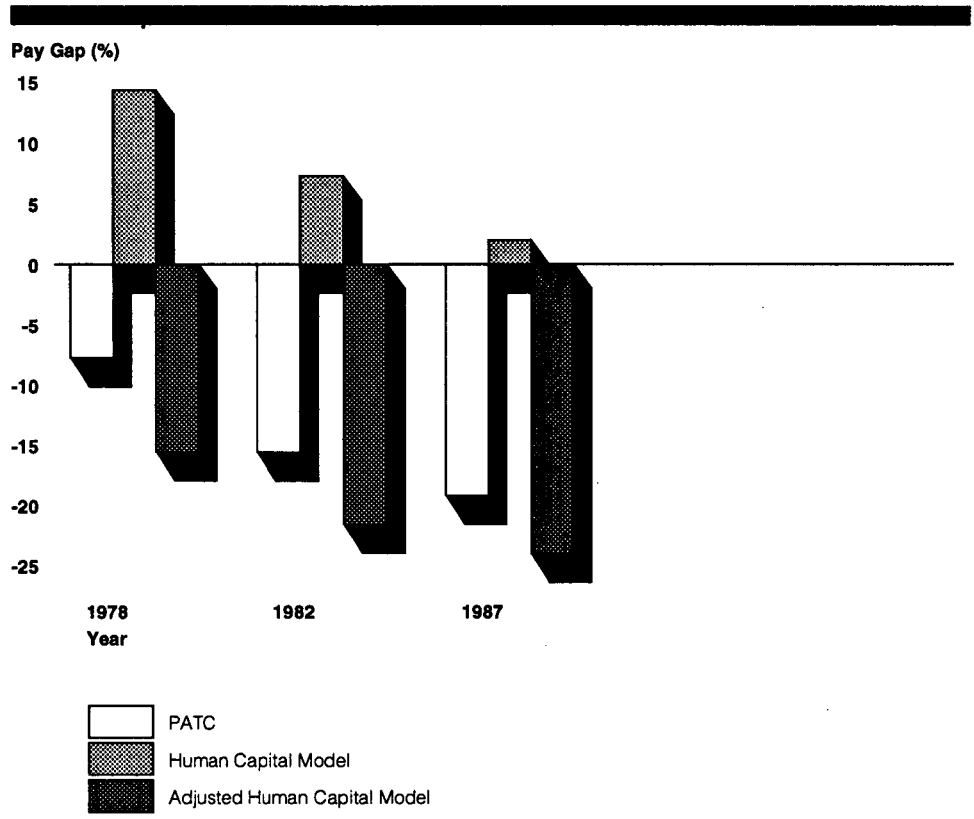


Source: GAO analysis of CPS data and Pay Agent's reports for various years.

The Effect of Employer Size and Federal Pay of Women and Minorities Combined

Finally, GAO adjusted the human capital model to reflect both employer size and the federal pay of women and minorities. The result is shown in figure 4. The combined effects of these two adjustments produce human capital estimates of the federal private pay gap that are similar to the official estimates.

Figure 4: The Pay Gap Adjusted for Employer Size and the Federal Pay of Women and Minorities



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

Although the literature GAO reviewed suggested the two factors that were selected for analysis, there may be other factors that also affect estimates of the pay gap.

Implications of GAO's Analysis

GAO's analysis demonstrates the importance of considering the effects of employer size and race and gender on private sector pay when evaluating the two approaches for measuring pay comparability. For example, human capital estimates of the pay gap may be sensitive to the choice of comparison groups.

In addition, GAO's analysis should be interpreted within the broader framework of federal personnel management policy. Federal personnel

management policy includes important factors, such as workforce quality, recruitment and retention, affirmative action, and employee benefits, which may be influenced by the level of pay. Because these factors are beyond the scope of this report, GAO's analysis cannot by itself be used to judge the appropriateness of comparability estimates or the level of federal pay.

GAO's analysis found that both the position comparison and the human capital estimates have limitations. For example, neither method can account for how qualified employees are for the jobs they do or for the level at which they perform.

There is no easy answer to the question of the appropriateness of federal general schedule compensation—pay and benefits. Any limitations of pay comparisons do not necessarily invalidate the use of such comparisons in determining appropriate levels of compensation. Even if there were no disagreement as to the size of the pay gap, paysetters and lawmakers would need to carefully weigh all aspects of the compensation question to determine the appropriate level of federal compensation.

Recommendations

This report contains no recommendations.

Agency Comments

GAO received written comments on a draft of this report from BLS and the Office of Personnel Management (OPM). BLS offered a number of clarifications and technical corrections, which have been incorporated into the report as appropriate. OPM said the report was useful. The Office of Management and Budget (OMB) was also provided a draft of this report but declined to comment on it.

Contents

Executive Summary		2
Chapter 1 Introduction		16
	Background	16
	Objectives, Scope, and Methodology	19
Chapter 2 Academic Studies Appear to Contradict Official Pay Comparisons		21
	Official Estimates Find Federal Pay Low	21
	Possible Explanations for the Different Findings	24
	Conclusion	28
Chapter 3 The Effects of Employer Size and Employee Race and Gender Are Significant Factors in Pay Comparisons		29
	Human Capital Estimates of Pay Gap Differ From Official Estimates	30
	Analysis of Differences Between the Pay Agent's Reports and the Human Capital Analysis	32
	Conclusion	37
Chapter 4 Implications of GAO'S Analysis		38
	Position Comparisons and Human Capital Estimates Are Limited in Measuring Pay Comparability	38
	Compensation Levels Are Not Independent of Personnel Management Priorities	43
Appendixes	Appendix I: Analyses of Total Compensation Comparability	46
	Appendix II: Federal Pay Comparability Process	49
	Appendix III: Current Population Survey	55
	Appendix IV: GAO's Econometric Analysis: Detailed Description and Methodological Considerations	56
	Appendix V: May CPS Sample Statistics and Regression Results	65
	Appendix VI: Comments From the Bureau of Labor Statistics	77
	Appendix VII: Comments From the Office of Personnel Management	80
	Appendix VIII: Major Contributors to This Report	81

Tables

Table 2.1: General Schedule Pay Adjustments for 1979-89 22
Table 2.2: Human Capital Studies on the Federal Private Pay Gap 24
Table II.1: Occupations and Work Levels Surveyed by PATC in 1988 50
Table II.2: Selected GS-Equivalent Grades of PATC Work Levels in 1988 52
Table IV.1: Human Capital Estimates of the Federal/Private Pay Gap As Measured by the Federal Dummy Variable 59
Table IV.2: An Example of the Calculation of the Pay Gap as a Weighted Average 61
Table IV.3: Data For Federal Private Pay Gaps Calculated as a Weighted Average 62
Table V.1: Variable Names and Descriptions 65
Table V.2: Basic Earnings Regression for May 1979 67
Table V.3: May 1979 Earnings Regression Adjusted for Employer Size 67
Table V.4: May 1979 Earnings Regression With Sector-Specific Race and Gender Dummies 68
Table V.5: May 1979 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects 69
Table V.6: Basic Earnings Regression for May 1983 70
Table V.7: May 1983 Earnings Regression Adjusted for Employer Size 70
Table V.8: May 1983 Earnings Regression With Sector-Specific Race and Gender Dummies 71
Table V.9: May 1983 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects 72
Table V.10: Basic Earnings Regression for May 1988 73
Table V.11: May 1988 Earnings Regression Adjusted for Employer Size 73
Table V.12: May 1988 Earnings Regression With Sector-Specific Race and Gender Dummies 74
Table V.13: May 1988 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects 75
Table V.14: Sample Statistics for Regression Analysis 76

Figures

Figure 1: The Pay Gap as a Percentage of Private Sector Pay 5
Figure 2: The Pay Gap Adjusted for Employer Size 6
Figure 3: The Pay Gap Adjusted for the Federal Pay of Women and Minorities 8

Figure 4: The Pay Gap Adjusted for Employer Size and the Federal Pay of Women and Minorities 9
Figure 3.1: The Pay Gap as a Percentage of Private Sector Pay 30
Figure 3.2: May CPS Pay Gap Estimate 32
Figure 3.3: The Pay Gap Adjusted for Employer Size 34
Figure 3.4: The Pay Gap Adjusted for the Federal Pay of Women and Minorities 35
Figure 3.5: The Pay Gap Adjusted for Employer Size and the Federal Pay of Women and Minorities 36

Abbreviations

ADF	Annual Demographic File
BLS	Bureau of Labor Statistics
CBO	Congressional Budget Office
CPS	Current Population Survey
CRS	Congressional Research Service
CSRS	Civil Service Retirement System
ECI	Employment Cost Index
EEO	equal employment opportunity
FEPCA	Federal Employees Pay Comparability Act of 1990
GS	general schedule
NIST	National Institute of Standards and Technology
OMB	Office of Management and Budget
OPM	Office of Personnel Management
PATC	National Survey of Professional, Administrative, Technical, and Clerical Pay
TCC	total compensation comparability

Introduction

The federal government's official surveys of the pay—wages and salaries—of federal and private sector employees have indicated that federal pay has lagged behind prevailing levels for comparable jobs in private enterprise and that the pay gap has grown over the last 2 decades. However, these official estimates of the pay gap have been subjected to criticism in both academic circles and in the media. Critics argue that the official methodology for performing pay comparisons is defective and that data from sources other than the official surveys, when analyzed using a different methodology, lead to a different conclusion—that federal pay levels are higher than prevailing levels for employees with comparable characteristics, such as education and work experience, in private enterprise.

In view of these opposing conclusions, we identified two possible explanations for the discrepancy between official estimates of the federal private pay gap and those of the critics. We then performed a statistical analysis to determine the empirical significance of these explanations for estimates of the pay gap. Our analysis does not address whether and to what extent federal employees are under- or overpaid.

Background

Personnel management policy encompasses such issues as pay and benefits, recruitment, promotion, retention, and in certain circumstances, the management of reductions in force. Personnel management also encompasses such issues as ethics policies (e.g., restrictions on postfederal employment) and equal employment opportunity (EEO) policies.

A number of tools are available to employers, including federal agencies, as they attempt to achieve their personnel management goals. These include such tools as allocating resources to recruitment and providing on-the-job training for employees.

Compensation Policy Is an Important Component of Personnel Management Policy

The level of compensation—pay and benefits—that government agencies offer their employees can have a substantial impact on the success of these agencies in recruiting and retaining qualified employees. As such, the process by which compensation is determined is an important component of overall personnel management policy.

Federal Pay Reform Adopted Locality-Based Pay

The Federal Employees Pay Comparability Act of 1990 (FEPCA) is the most recent comprehensive reform of the federal paysetting process. Under FEPCA, federal pay is compared to that of nonfederal (including employees of state and local governments) employees rather than only those in private enterprise. The annual governmentwide adjustment has been separated into two components—national and local. The national component when granted would prevent federal salaries from falling substantially further behind nonfederal sector salaries. This result is accomplished by linking the annual governmentwide increase to the percentage increase in the Employment Cost Index (ECI).

Under FEPCA, the paysetting process relies on position comparison information to measure the local pay gaps. Federal employees may receive an additional increase in pay that is designed to reduce the local pay gaps. Partial adjustments (based on a formula specified in FEPCA) are accorded eligible employees until the pay gap for their area becomes sufficiently small.

This paysetting process relies directly upon a position comparison method for gathering and interpreting the data needed to determine local pay comparability. Before FEPCA, a similar method was used to determine national comparability. (See ch. 2.)

Experts Have Suggested Further Changes in Federal Pay Policy

Critics of current federal pay policies claim that even with recent reforms under FEPCA, the policies and their mechanisms are deficient in several specific respects. For instance, some have raised the issue of whether the general schedule (GS) is sufficiently flexible to permit federal agencies to compete effectively in the variety of circumstances in which they must recruit and retain employees.[1] In particular, the GS prescribes uniform pay rates that do not necessarily take into account differences in prevailing rates of pay in particular occupations.[2]

[1]The GS is a pay table that governs the salaries of most federal employees in professional, administrative, clerical, and technical occupations. Federal employees covered by the GS comprise more than 50 percent of the federal civilian workforce. There are several salary schedules governing other groups of federal employees. Among these are the executive schedule, the senior executive service schedule, the postal schedule, and the judicial salaries schedule.

[2]However, in some instances federal agencies can obtain authority to offer higher pay for selected occupations, if they can demonstrate difficulties in recruiting and retaining employees in those occupations.

Pay Comparisons and Paysetting Are Two Different Concepts

The principle of comparability between federal and private (and under FEPCA, nonfederal) sector pay—and the use of comparability surveys—has played an important role in the paysetting process for more than 30 years. However, it does not necessarily follow that future decisions concerning the level of compensation should be completely determined by the findings of comparability surveys. Policymakers may want to provide for other factors to be taken into account, such as

- possible differences in fringe benefits and other nonpay characteristics (e.g., job security) of federal and nonfederal employment;
- evidence of difficulty in recruiting and retaining federal employees, either in general or in specific occupations and localities;
- budgetary pressures faced by the federal government at any given point in time (e.g., a perceived need to control deficit spending); and
- judgments concerning the desired quality of the federal workforce.

The Validity of Official Estimates of the Pay Gap Has Been Questioned

The government's official comparisons of federal and private sector pay have indicated that federal pay has lagged behind prevailing levels for comparable jobs in private industry and that the pay gap is growing. On the basis of evidence such as this, some analysts of federal pay policy have said that pay is low and has led to personnel management problems. For instance, the National Commission on the Public Service (commonly known as the Volcker Commission) has said that a "quiet crisis"—due in part to low pay—in federal employment threatens the quality of the government's day-to-day performance.

Other analysts of federal pay policy dispute the contention that federal employees are underpaid. To some extent, their position reflects disagreements concerning such policy issues as whether federal agencies should attempt to attract and retain the "best and brightest" talent. However, on a more technical level, some of these analysts—mostly academic labor economists—have questioned the validity of official estimates of the pay gap. They point to evidence on the relative pay of federal and nonfederal employees from data sources other than those used to determine the official pay gap. According to these analysts, this evidence would seem to suggest that federal employees are, if anything, overpaid when compared with their nonfederal counterparts. In other words, federal employees are said to receive a premium. Further, these analysts say that evidence on the number of applicants for federal employment and the rate at which federal agencies retain employees does not support the notion that federal agencies generally have problems in

recruiting and retaining employees. Although these analysts usually have not identified what they consider to be specific defects in the methodology underlying the official pay gap estimates, they claim their evidence shows that something must be wrong with it.

Objectives, Scope, and Methodology

In light of the ongoing controversy concerning the existence and size of the official pay gap, we reviewed the methodologies that have been used to estimate the federal private pay gap. Our objective was to evaluate possible explanations for the apparent disagreement about the existence and the size of the pay gap.

We limited our review to technical issues related to the collection and interpretation of data on pay comparability. We did not address broader issues in compensation policy, such as desired employee quality; nor did we attempt to determine whether federal white-collar employees are over- or underpaid.

We limited the scope of our review to the pay gap as it applies to the general schedule, which governs the salaries of most federal white-collar employees. We did not review issues relating to the accuracy and quality of the data sources used to estimate the pay gap.[3] Finally, we limited the scope of our empirical work to comparisons of pay. We did not analyze data on nonwage job characteristics, success in recruitment and retention, or other potentially relevant variables.[4]

We reviewed the relevant literature, including academic research studies, reports by government agencies, and studies prepared under contract to government agencies. We also interviewed analysts at the Bureau of Labor Statistics, the Office of Personnel Management, the National Institute of Standards and Technology (NIST), the Congressional Budget Office (CBO), and other organizations. On the basis of this information, we identified

[3]We reported on the quality of the data used for official estimates in Additional Improvements Needed in the National Survey of Professional, Administrative, Technical, and Clerical Pay (GAO/FPCD-82-32, Apr. 5, 1982), and Federal Pay: Changes to the Methods of Comparing Federal and Private Sector Salaries (GAO/GGD-87-8, May 14, 1987).

[4]See appendix I for a review of previous analyses of federal nonfederal differences in nonpay conditions of employment. On the basis of this review, we determined that it was not feasible to incorporate data on these conditions in our analysis. Therefore, we limited the scope of our analysis to comparisons of the pay of federal and private sector employees, consistent with the methodologies that are used by both the Pay Agent and the academic studies discussed in chapters 2 and 3 of this report. However, we note that the evidence from the studies we reviewed suggests that if we were able to construct broader measures of compensation for federal and private employees, the resulting pay gap estimates defined in terms of such measures would most likely not differ substantially from those reported here.

possible explanations that might reconcile the different estimates of the pay gap produced by the different methodologies.

We developed and estimated an econometric model using data from the Current Population Survey, a major survey of the U.S. workforce. The purpose of this analysis was to test hypotheses of why different methodologies lead to different estimates of the pay gap. In particular, we analyzed relatively unexploited data on employer size collected as part of CPS for the years 1978, 1982, and 1987, the most recent years for which these data were available. We did our work in Washington, D.C., in accordance with generally accepted government auditing standards.

We received comments from several academic labor economists at various stages of our work. We received written comments on a draft of this report from BLS (see app. VI) and OPM (see app. VII). BLS offered several clarifications and technical corrections, which we have incorporated into the report. OPM said the report was useful. The Office of Management and Budget was also offered an opportunity to review this report but declined.

Academic Studies Appear to Contradict Official Pay Comparisons

The method of calculating the government's official estimates of the pay gap has been an ongoing source of controversy. Over the years, the official estimates have been contradicted by academic studies on the pay gap. The official estimates have consistently shown that federal employees are paid relatively less than comparable private sector employees. However, the academic studies we reviewed generally concluded that federal employees are paid relatively more.

In this chapter, we discuss the different methods employed by the government and the academic researchers. We summarize the findings of a number of academic studies and contrast them with official pay gap estimates for the same period. We then identify possible explanations for why these analyses produce such opposing conclusions.

Official Estimates Find Federal Pay Low

For the period covered by our review, applicable federal law required that federal pay rates be "comparable" to those of private sector employees for the same level of work. Different mechanisms exist to establish pay levels for various segments of the federal workforce. Until 1989, pay gaps for the largest of these segments—white collar, nonpostal employees covered under the general schedule—were usually computed annually on the basis of the National Survey of Professional, Administrative, Technical, and Clerical Pay (PATC).[1] PATC, which was conducted by BLS, provided nationwide salary information on selected white-collar occupations in the private sector. The Pay Agent (the Secretary of Labor and the Directors of OMB and OPM) was charged with selecting PATC occupations, and ensuring that they appropriately represented a broad range of federal white-collar occupations. On the basis of PATC, the Pay Agent determined and reported annually to the President the pay adjustments necessary to maintain pay comparability. The President had the option of submitting an alternative proposal for pay increases to the Congress.

PATC consistently showed that federal employees were paid less than their private sector counterparts. Until the mid-1970s, federal salaries were raised most years by an amount that, according to the Pay Agent, would achieve pay comparability. From 1977 until 1989, however, the President has recommended increases that were lower than those needed to achieve pay comparability as determined by the Pay Agent. As reported by the Pay Agent, the result of these successive recommendations for

[1]We discuss PATC in more detail, and the paysetting process in general, in appendix II. As we noted in chapter 1, there have been recent changes to the process, which are also discussed in appendix II. Despite the changes, such as locality pay, the paysetting process continues to rely on position-based pay comparisons similar to those used in PATC.

lower-than-comparable pay increases and subsequent congressional action has been to sharply reduce the relative pay of federal employees in all GS levels. As table 2.1 shows, the official federal pay gap increased from 10 percent in 1979 to 26 percent in 1989.

Table 2.1: General Schedule Pay Adjustments for 1979-89

Date	Pay gap as reported by Pay Agent	Size of increase provided
October 1979	10.41%	7.00%
October 1980	13.46	9.10
October 1981	15.10	4.80
October 1982	18.47	4.00
January 1984	21.51	4.00
January 1985	18.28	3.50
January 1986	19.15	0.00
January 1987	23.79	3.00
January 1988	23.74	2.00
January 1989	26.28	4.10

Source: Office of Personnel Management, and Congressional Research Service.

Pay Comparisons Based on the Human Capital Approach Find Federal Pay High

In marked contrast to PATC, academic studies have consistently concluded that federal employees are paid more than their private sector counterparts. Those studies generally employed a human capital approach. Rather than comparing the pay of similar jobs, as did the official pay comparisons, the human capital method compares the pay of individuals with similar personal characteristics, such as education and work experience.

Under human capital theory, employees are seen as embodying a set of skills that can be "rented" out to firms through employment. The more valuable the knowledge and skills an employee possesses, the higher the rent (i.e., the employee's pay). An individual can acquire more valuable knowledge and skills through education and work experience. Each of these activities generally requires that the individual incur some initial costs, either in the form of out-of-pocket expenses (e.g., tuition) or opportunities forgone (e.g., rejecting a better paying but "dead-end" job in favor of one with more opportunity for advancement). When an individual decides to incur some initial cost to acquire knowledge and skills that will lead to higher pay, such a decision is analogous to a business deciding to buy a new machine in order to obtain returns from its services in the

future. These examples show how the knowledge and skills of an employee can be viewed as productive "human capital," analogous to the physical capital that business plant and equipment represent, and the initial costs to acquire knowledge or skills can be viewed as "investments" in human capital. The human capital approach assumes that, to the extent that education and training are valued only because they enhance pay, individuals will not invest in such human capital unless the return in the form of enhanced earnings over the employee's life at least covers all of their costs, including interest.

Therefore, with the human capital approach, it appears that differences in earnings among individuals and groups can partly be explained by observable differences in investments in human capital. Labor economists have used this method to study the effect education and work experience have on the level, time pattern, and distribution of earnings. Statistical methods have been employed to develop empirical formulas that implement this approach; such formulas are called earnings functions.

The human capital approach has also been applied to study whether employees in one group are paid the same as those in other groups with comparable investments in human capital. Examples of such applications are studies of pay differences between men and women, minorities and whites, and union and nonunion members. By employing statistical methods that take into account the effect of education and work experience, researchers have estimated the percentage of pay differences that are attributable to gender, race, and union status.

A number of academic studies have employed the human capital approach to estimate the federal private sector pay gap. The source for the data that are most commonly used in these studies is the CPS, which we discuss in appendix III. One early study based on a 1978 CPS sample indicated that federal male employees were overpaid by 11 percent and federal female employees by 21 percent.[2] The official pay gap estimate that was based on the 1978 PATC survey indicated that the federal pay was lower than private sector pay by about 8 percent.[3]

[2]Sharon Smith, "Public/Private Wage Differentials in Metropolitan Areas," Public Sector Labor Markets, eds. Peter Mieszkowski and George E. Peterson (Washington, D.C.: Urban Institute, 1981).

[3]The numbers that we present in this section and in the remainder of the report differ slightly from those reported by the Pay Agent, which we present in table 2.1. We report the pay gap as a percentage of private sector pay, whereas the Pay Agent reported the pay gap as a percentage of federal pay.

The study did not take into account differences in employee characteristics other than years of education and work experience. It also did not capture the effects of differences in nonwage job attributes, such as work environment and fringe benefits. To account for the effects of some of these factors, later studies, each employing elaborate and sophisticated econometric techniques, have made a variety of modifications to the standard human capital model.[4] Nevertheless, their findings, as shown in table 2.2, are more or less similar. The studies all indicated that federal pay was higher than private sector pay.

Table 2.2: Human Capital Studies on the Federal Private Pay Gap

	Year		Pay gap (in percent)[a]			Sample size	
Author	**Publ.**	**Studied**	**Over-all**	**Male**	**Female**	**Total**	**Federal**
Smith	1981	1978	[a]	11	21	13,148	[a]
Venti	1987	1982	[a]	4	22	10,625	318
Gyourko-Tracy	1988	1977	17.6	[a]	[a]	13,907	431
Krueger	1988	1984, 1986	11.0	[a]	[a]	3,844	59

Note: For this table, the pay gap represents the percentage by which federal salaries exceed private salaries.

[a]Not reported.

Source: See footnote 4.

Possible Explanations for the Different Findings

On the basis of our literature review and discussions with experts in this area, we identified two possible explanations for the discrepancy between the Pay Agent's estimates and those reported in the studies by academic researchers.[5] One such explanation for the discrepancy is that a pay comparison that uses data from a survey like PATC compares the pay of federal employees to that of employees of predominantly large companies

[4]Steven F. Venti, "Wages in the Federal and Private Sectors," Public Sector Payrolls, ed. David Wise (Chicago: The University of Chicago Press, 1987); 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 (1988), pp. 229-53; Alan B. Krueger, "Are Public Sector Workers Paid More Than Their Alternative Wage? Evidence from Longitudinal Data and Job Queues," When Public Sector Workers Unionize, eds. Richard B. Freeman and Casey Ichniowski (Chicago: The University of Chicago Press, 1988), pp. 217-240; Brent R. Moulton, "A Reexamination of the Federal-Private Wage Differential in the United States," Journal of Labor Economics, Vol. 38, No. 2 (1990), pp. 270-293.

[5]A discussion of these explanations can be found in Richard B. Freeman, "How Do Public Sector Wages and Employment Respond to Economic Conditions," Public Sector Payrolls, ed. David A. Wise (Chicago: The University of Chicago Press, 1987), especially pp. 189-193.

in similar occupations, while the academic studies compare the pay of federal employees to that of employees of nonfederal employers of all sizes, regardless of the employee's occupation. Employees of small private employers with given investments in human capital tend to be paid less than their counterparts in large private firms. As we discuss below, human capital pay gap estimates may reflect the lower pay of employees of small employers.

The other explanation for the discrepancy is that position comparisons compare pay for employees in the same occupation and work level, ignoring the personal characteristics of the employees compared. By contrast, human capital methods implicitly compare employees of the same age, education, race, and gender, largely ignoring occupation and responsibilities. Privately employed women and minorities with given investments in human capital tend to be paid less than their counterparts in the federal sector. As we discuss below, this fact may have different implications for position comparison and human capital pay gap estimates.

The two factors that we have identified were suggested by our literature review and discussions with experts, and they lend themselves to further analysis with the data that are available to us. However, there may be other factors that have contributed to the discrepancy.[6]

Employer Size

The empirical evidence of a positive relationship between pay and employer size is overwhelming. Even after allowing for employee characteristics, numerous studies have found that larger employers pay more.[7] The same relationship also appears to apply outside of the United

[6]For instance, one expert on federal personnel management policy has advanced the hypothesis that employees with given investments in human capital tend to have different levels of responsibility in the federal and private sectors. See Robert W. Hartman, Federal Pay and Pensions (Washington: Brookings Institution, 1983), pp. 40-45. In addition, an OMB official suggested to us the possibility that the process of identifying position matches may be imperfect.

[7]Stanley H. Masters, "Wages and Plant Size: An Interindustry Analysis," Review of Economics and Statistics, Vol. 51 (1960), pp. 341-345; Sherwin Rosen, "Unionism and the Occupational Wage Structure in the United States," International Economic Review, Vol. 11 (1970), pp. 269-286; Charles T. Haworth and Carol Jean Reuther, "Industrial Concentration and Interindustry Wage Determination," Review of Economics and Statistics, Vol. 60 (1978), pp. 85-95; Wesley Mellow, "Employer Size and Wages," Review of Economics and Statistics, Vol. 64, No. 3 (1982), pp. 495-501; John E. Garen, "Worker Heterogeneity, Job Screening, and Firm Size," Journal of Political Economy, Vol. 93, No. 4 (1985), pp. 715-739; Charles Brown and James Medoff, "The Employer Size-Wage Effect," Journal of Political Economy, Vol. 97, No. 5 (1989), pp. 1027-1059.

States.[8] Moreover, one study finds that this relationship prevails when analysts compare the pay of employees of organizations of various sizes within the public sector as well.[9]

Position comparison surveys like PATC tend to reflect the compensation levels of larger employers. The specialization and distinct level of responsibility associated with many federal occupations mean that matches are more likely to be found in larger nonfederal organizations. Once a position match is found, there are likely to be more employees employed in any such position when the match is found in a large organization than for a smaller one.[10]

By contrast, human capital estimates of the pay gap generally have been based on data from sources such as CPS, which cover employees of employers of all sizes. Thus, a PATC-based approach compares federal employees to nonfederal employees of predominantly large companies while most human capital estimates compare federal employees to nonfederal employees of companies of all sizes.

Because large employers pay more than small ones, employer size could affect estimates of the federal private pay gap. To date, few academic studies of the federal private sector pay gap have attempted to isolate the effect of employer size on the difference in pay between the two sectors.[11]

The Federal Pay of Women and Minorities

Federal personnel management policy implements the government's commitment to prohibit all types of illegal discrimination and takes affirmative action to ensure equal employment opportunity (EEO). Although similar legal requirements apply to private sector employers, several human capital studies show that on average private employers are likely to pay lower wages than federal employers to women and minorities

[8]Robert Evans, for example, finds that in Japan larger employers pay substantially more than smaller ones in "Pay Differentials: The Case of Japan," Monthly Labor Review, Vol. 107, No. 10 (1984), pp. 24-29.

[9]Charles C. Brown and James L. Medoff, "Employer Size, Pay, and the Ability to Pay in the Public Sector," When Public Sector Workers Unionize, eds. Richard B. Freeman and Casey Ichniowski (Chicago: The University of Chicago Press, 1988), pp. 217-240.

[10]BLS has undertaken initiatives to include more small employers in its surveys. These efforts to increase smaller employers' representation have been costly and have not appreciably affected official comparability estimates because few position matches were found in the smaller private firms surveyed by BLS.

[11]One such study is Dale Belman and John S. Heywood, "The Effect of Establishment and Firm Size on Public Wage Differentials," Public Finance Quarterly, Vol. 18, No. 2 (1990), pp. 221-235. They found that when employer size is taken into account in human capital models it is unclear that federal pay is higher than private sector pay; this is contrary to the findings of most other human capital studies.

with comparable investments in human capital.[12] Thus, there is a strong possibility that differences in the levels of pay for women and minorities between the two sectors may affect estimates of the pay gap.

Further, there is evidence that to the extent that the pay of women and minorities tends to be lower in the private sector, it largely takes the form of a higher concentration of women and minorities in lower-paying occupations, as opposed to unequal pay within narrowly defined occupations. To this extent, a pay comparison that is based on position comparisons within categories that are defined in terms of both occupation and work level, such as PATC, is likely to be less affected by race and gender effects. By contrast, human capital methods, which compare pay across occupations, are likely to be affected. Hence, human capital estimates may be sensitive to the specific assumptions that analysts make regarding race and gender effects.

One decision regarding race and gender effects that analysts implicitly make when estimating federal private sector pay gaps concerns the choice of private sector comparison group. The possible options involve implicit assumptions about the reasons for race- and gender-based pay differences within the private sector.

One way in which pay gaps can be computed in human capital models is to compare federal employees to all private sector employees. Such comparisons can produce a single estimate of the pay gap, assumed to be the same for all race-gender groups, or they can produce separate estimates of the pay gap for each race-gender group. The studies that we cite in table 2.2 use all private sector employees as the comparison group. Comparing federal employees to all private sector employees means the lower pay of private sector women and minorities, relative to private sector white males, will influence the size of the pay gap. Such a comparison implicitly assumes that private sector pay differences by race and gender are caused by unobserved productivity differences that are not necessarily related to education and work experience.[13]

[12]Martin Asher and Joel Popkin, "The Effect of Gender and Race Differentials on Public-Private Wage Comparisons: A Study of Postal Workers," Industrial and Labor Relations Review, Vol. 38, No. 2 (1984), pp. 16-25. See also Sharon Smith, "Pay Differential between Federal Government and Private Sector Workers," Industrial and Labor Relations Review, Vol. 29 (1976), pp. 179-197, and Equal Pay in the Public Sector: Fact or Fantasy (Princeton, N.J.: Princeton University Press, 1977).

[13]Human capital estimates are sensitive to how well education and work experience are measured. See chapter 4 for further discussion.

However, several researchers have argued that it is possible that a federal pay premium could result from federal white males being paid the same as private sector white males while federal women and minorities are paid more than their private sector counterparts, after controlling for education and work experience.[14] Based on this argument, an alternative method of computing the pay gap would be to compare the pay of federal white males, women, and minorities to the pay of private sector white males. Comparing all federal employees to private sector white males means the lower pay of private sector women and minorities, relative to private sector white males, will not influence the size of the pay gap. Such a comparison implicitly assumes that private sector pay differences by race and gender are caused by discrimination.

Using private sector white males as the benchmark for comparison could be described as a method that measures the upper limit of the contribution of private sector labor market discrimination to an explanation of the discrepancy between estimates of the pay gap. It is an upper limit if labor market discrimination and unobservable productivity differences share responsibility for private sector pay differences by race and gender.[15]

Conclusion

On the basis of our review of the relevant studies, we have identified two factors for further analysis that may affect estimates of the federal private pay gap. One factor is the effect of employer size on estimates of the pay gap. The other factor is the pay of federal women and minorities, relative to private sector white males. By identifying these two factors for further analysis, we do not mean to rule out the possibility that there are other contributing factors.

[14]Asher and Popkin, 1984; Jeffrey M. Perloff and Michael L. Wachter, "Wage Comparability in the U.S. Postal Service," Industrial and Labor Relations Review, Vol. 38, No. 2 (1984), pp. 26-35.

[15]We recognize the possibility that productivity differences may themselves be partly caused by discrimination in such factors as education or past employment.

The Effects of Employer Size and Employee Race and Gender Are Significant Factors in Pay Comparisons

In light of the opposing conclusions we discussed in chapter 2, we sought to determine why the estimates of the federal private pay gap that were reported by the Pay Agent differed from those derived from a human capital earnings function. Our review of academic studies pointed to private employer size and the federal pay of women and minorities as possible explanations. Our objective was to measure the effects of these possible explanations on human capital estimates of the pay gap.

This chapter presents the results of our human capital analysis of CPS data.[1] This analysis consisted of two parts. In the first part, the analysis of data on the earnings of full-time federal and nonfederal employees for each year from 1978 through 1987 used the standard human capital model. This part of the analysis served two purposes—first, to document trends in the size of the pay gap over this period, as measured using both the Pay Agent's and human capital methods; and second, to determine the extent to which these human capital estimates were consistent with those found by the academic researchers.

In the second part, we analyzed supplemental CPS data on earnings for the years 1978, 1982, and 1987[2] to determine the extent to which the opposing conclusions of the Pay Agent and the human capital analyses of CPS data could be accounted for by variations in employer size and by the earnings of federal women and minorities, respectively. We selected these years for analysis because CPS provided more detailed information on the characteristics of the respondents' employers, e.g.,(firm and establishment size) in these years, thereby enabling us to examine the possible explanations mentioned above.[3]

[1]The March CPS Annual Demographic File contains information on earnings and demographics that is commonly used by academics to estimate pay gaps using the human capital method. See appendix III for more information on this survey.

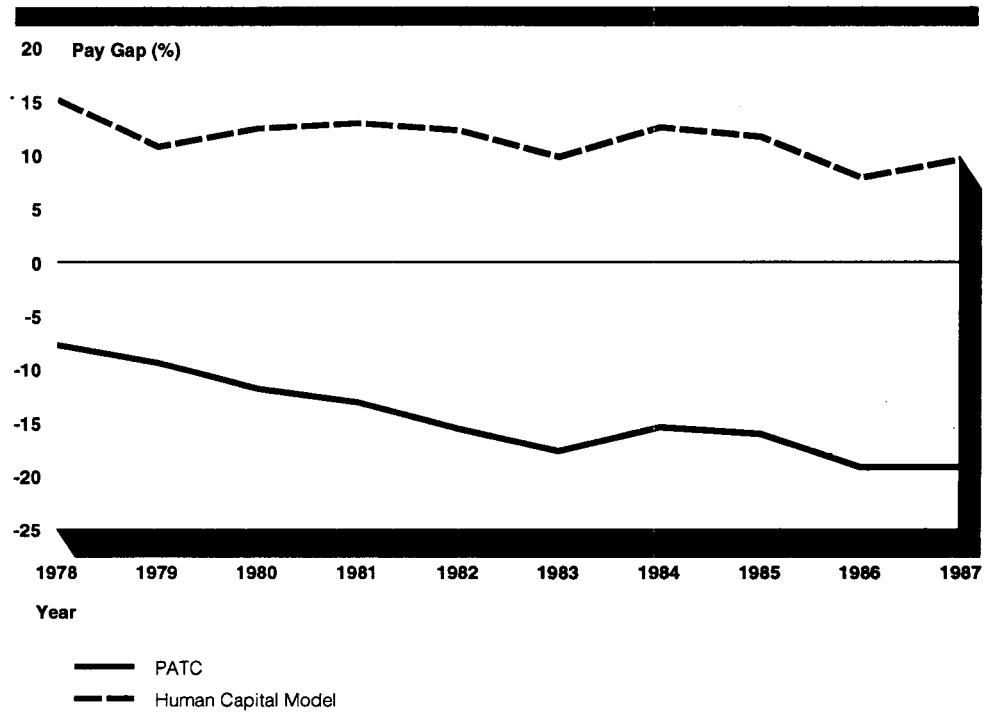
[2]We used May CPS supplements on pension and employee benefits that contained matching earnings and demographic information from the preceding March CPS. See appendix III for a more detailed discussion of this survey.

[3]See appendix IV for a more detailed discussion of the methodology used.

Human Capital Estimates of Pay Gap Differ From Official Estimates

GAO analyzed CPS data on full-time employees, ages 18 to 65, for the years 1978 through 1987 by estimating standard human capital earnings functions. The resulting estimated pay gaps and the corresponding pay gaps reported by the Pay Agent are shown in figure 3.1.[4]

Figure 3.1: The Pay Gap as a Percentage of Private Sector Pay



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

Estimates based on the standard human capital analysis of CPS data are strikingly different from those reported by the Pay Agent. The estimates that are based on standard human capital analysis of CPS data consistently show that federal employees are paid relatively more than their private sector counterparts, while official estimates of the pay gap based on PATC show the opposite.

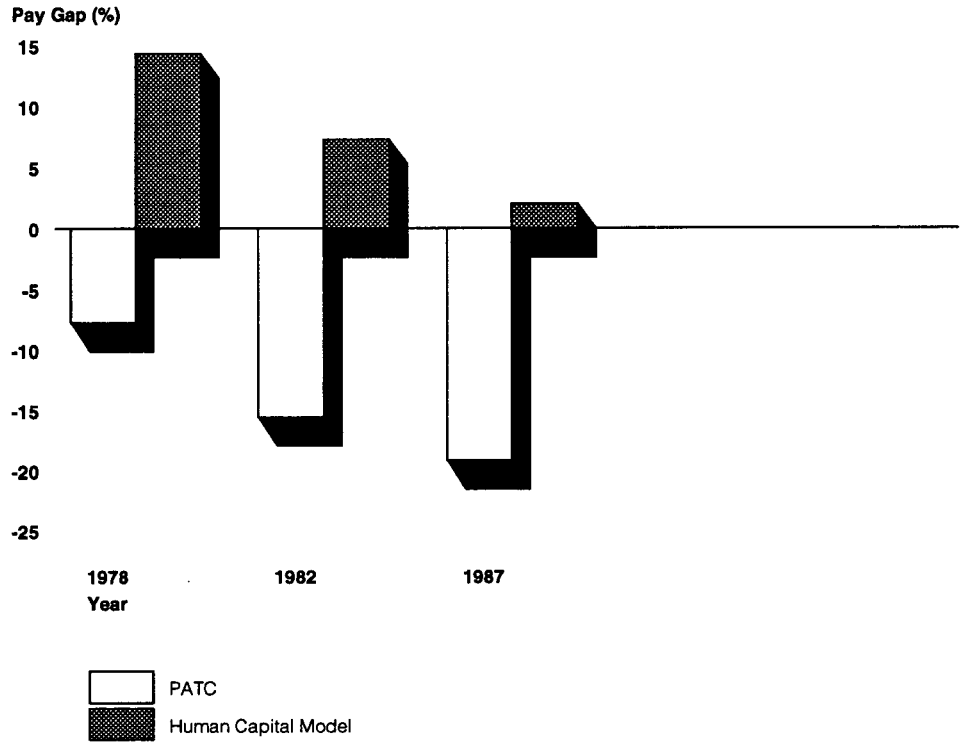
[4]We remind the reader that we have computed the pay gaps that we report here and elsewhere in this chapter in the manner that we describe in chapter 2. Also, we present the sample statistics and complete regression results that underlie this and other figures in appendix V.

These opposing conclusions mirror the findings of the human capital studies of the federal private pay gap we discussed in chapter 2. However, both the Pay Agent's and the human capital's estimates agree about the decrease in the relative pay of federal employees. The pay of federal employees, relative to the private sector, decreased by 6 to 14 percentage points over the period from 1978 to 1987.

CPS Pension Supplement Data Confirm Pay Gap Discrepancy

We estimated the pay gap for the years 1978, 1982, and 1987 by applying the standard human capital method to CPS pension supplement data. We narrowed the CPS sample to federal and private sector white-collar employees to better match those included in PATC. While the resulting pay gap estimates were lower than those shown in figure 3.1, both series of CPS-based estimates differed substantially from those based on PATC data. Pay gap estimates from the CPS-based human capital comparisons indicate that federal employees are paid relatively more than their private sector counterparts. Our estimates based on CPS pension supplement data and the corresponding Pay Agent's numbers are shown in figure 3.2. These human capital estimates based on the CPS pension supplement show that federal pay declined over the 10-year period by a little more than 12 percentage points.

Figure 3.2: May CPS Pay Gap Estimate



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

Analysis of Differences Between the Pay Agent's Reports and the Human Capital Analysis

Chapter 2 described two possible explanations for a discrepancy between estimates in the Pay Agent's reports and those published in academic studies. The first explanation concerns the relative pay of employees of large and small employers. The second explanation concerns the relative pay of women and minorities in private and federal employment. This section explains how we analyzed CPS data for selected years to determine the empirical importance of each of these possible explanations.

The Effect of Employer Size on the Pay Gap Estimates

Although annual CPS data did not regularly contain information on employer size, at approximately 5-year intervals a supplemental CPS survey on pensions and employee benefits collected the needed information on employer size. We expected that by using this employer size data when we produced human capital estimates of the pay gap, we could measure the

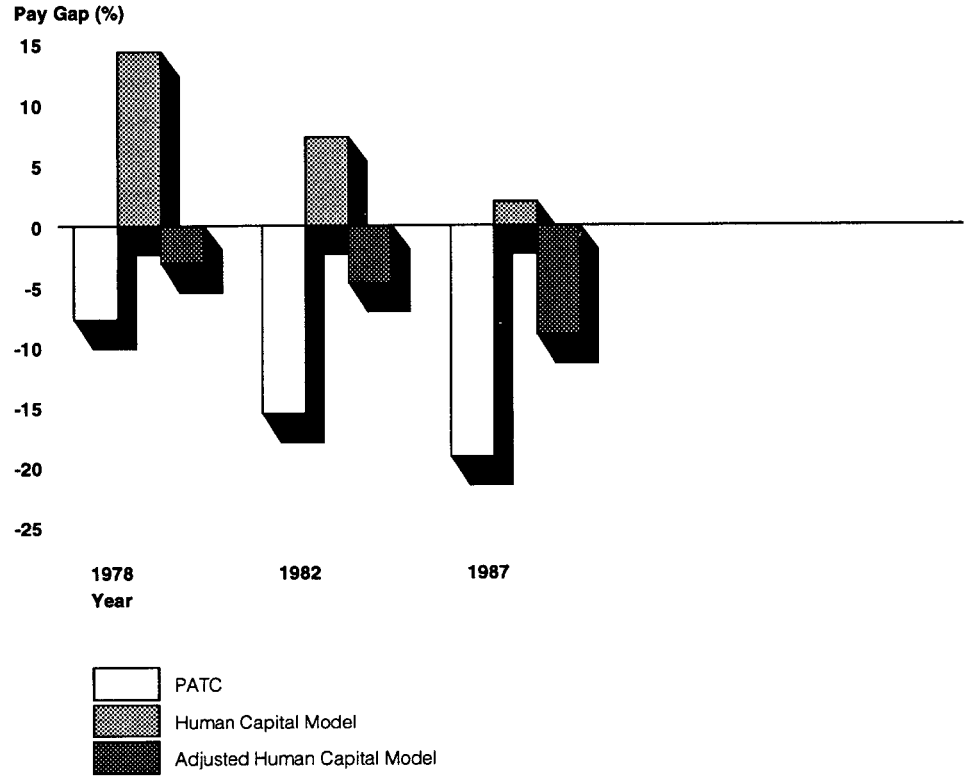
effect that employer size has on estimates of the federal private pay gap. To measure the effect of employer size on the pay gap, we again estimated the human capital earnings functions. In doing this estimate, we allowed for the effects of employer size, so that we compared the earnings of federal employees to the earnings of large private sector employers.[5]

The results of our adjustment are shown in figure 3.3. The figure shows that the discrepancy in the estimated pay gap was smaller after we adjusted for private sector employer size. This result strongly suggests that the greater proportion of employees from small employers in CPS compared with PATC contributes to the finding of a positive pay premium for federal employment in the CPS-based estimates.[6]

[5]As explained in appendix IV, our analysis provides a comparison of the average federal employee to the average employee in a private sector establishment with over 1,000 employees, after adjusting for other characteristics, such as education and experience. This represents an approximation to the effect that employer size could have on the discrepancy in pay gap estimates, because not all private establishments surveyed in PATC have over 1,000 employees.

[6]This finding is broadly consistent with that of the Belman-Heywood study cited in chapter 2.

Figure 3.3: The Pay Gap Adjusted for Employer Size



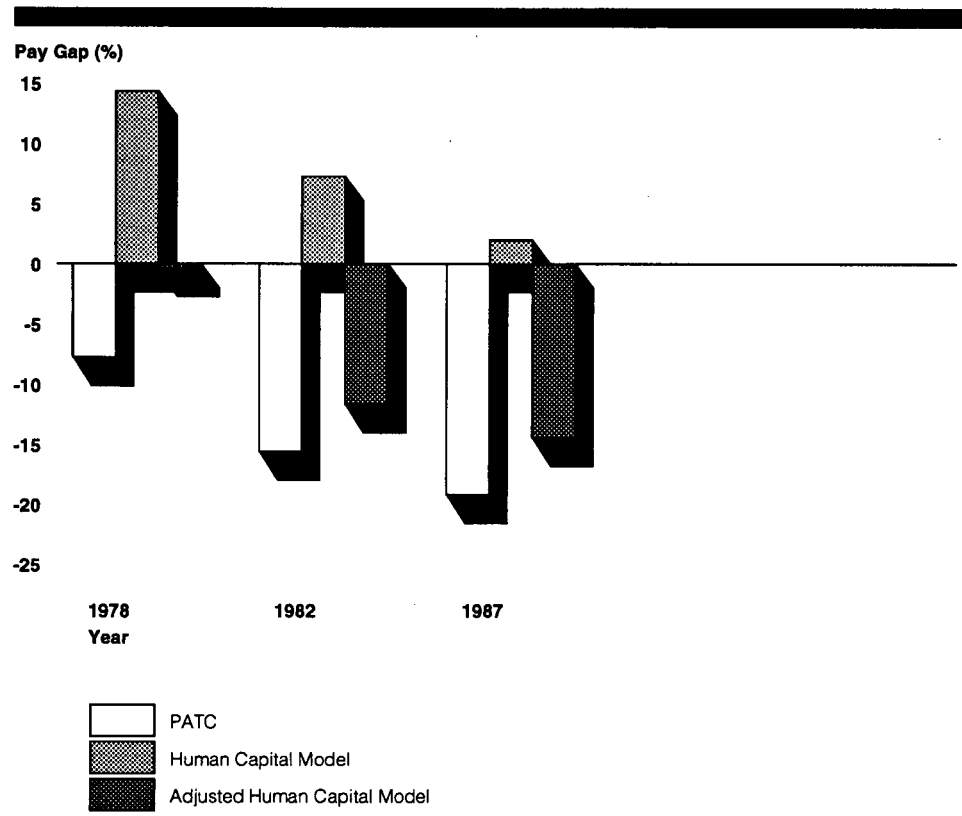
Source: GAO analysis of CPS data and Pay Agent's reports for various years.

The Effect of the Federal Pay of Women and Minorities on Pay Gap Estimates

We also reestimated human capital earnings functions in a way that allowed us to compare the pay of federal employees in all race and gender groups to the pay of private sector white males, after controlling for education and work experience. We then computed pay gap estimates as a weighted average of the race gender-specific federal private pay gaps. (See app. IV).

Figure 3.4 shows that the discrepancy in the estimated pay gap is smaller after this adjustment for the higher federal pay of women and minorities. This result shows that the manner in which the analyst accounts for the higher federal pay of women and minorities can affect estimates of the pay gap. The gap is smaller when federal white males, women, and minorities are compared to private sector white males rather than to private sector white males, women, and minorities, respectively.

Figure 3.4: The Pay Gap Adjusted for the Federal Pay of Women and Minorities



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

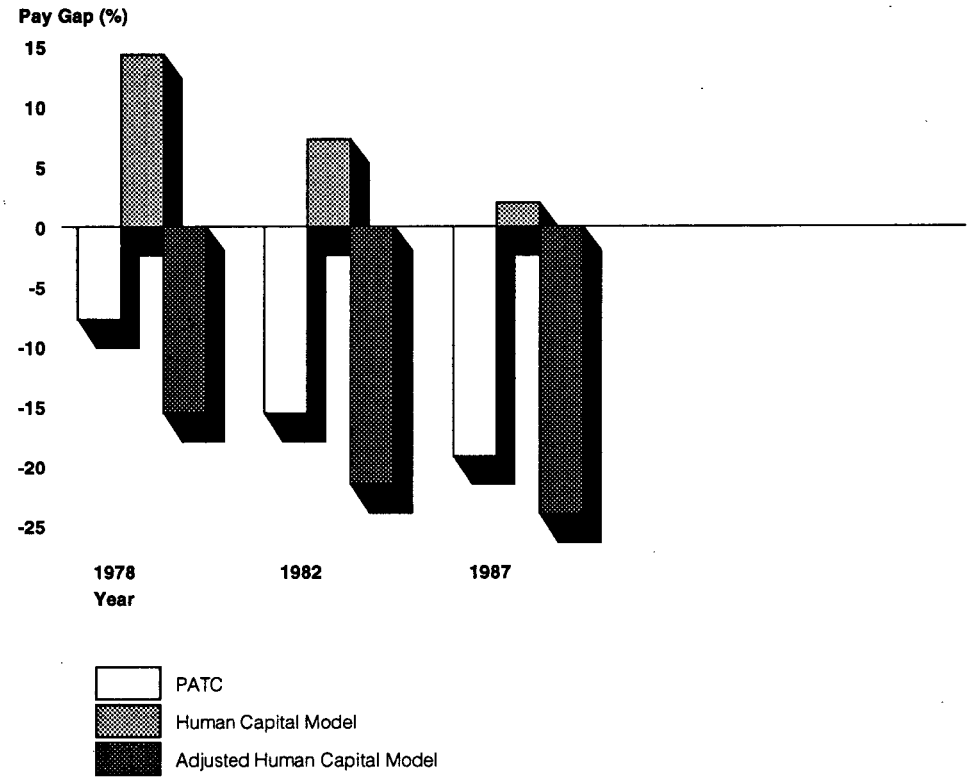
The Combined Effect of Employer Size and the Federal Pay of Women and Minorities

Our adjustments for the effects of employer size and the federal pay of women and minorities each account for a substantial amount of the difference between human capital and official estimates of the pay gap. If we were to add these two potential effects together, the total would exceed the difference between the Pay Agent's estimate of the federal private pay gap and the alternative measure from the simple human capital method.

This suggests that the effects of employer size and employee race and gender together potentially could account for the full discrepancy in measuring the pay gap. However, these factors may be interrelated in a statistical sense. In this case, both adjustments may be measuring roughly the same thing. The addition of the separately estimated effects would then be misleading.

To determine whether the effects of employer size and employee race and gender were interrelated in the human capital method, both sets of factors need to be adjusted simultaneously. By including controls for the effects of employer size and employee race and gender, we measured the joint effect of these factors on estimates of the pay gap. Our results are shown in figure 3.5.

Figure 3.5: The Pay Gap Adjusted for Employer Size and the Federal Pay of Women and Minorities



Source: GAO analysis of CPS data and Pay Agent's reports for various years.

The combined effect of the two possible causes of the discrepancy is roughly equal to the difference between the two pay gap measures. Our analysis explained the discrepancy by adjusting for the effects of employer size and sector-specific pay gaps related to race and gender. The effects of employer size and employee race and gender appear to be substantially

independent. Although we analyzed the two effects identified in our review of previous analyses of the pay gap, there may be other factors that contribute to the opposing conclusions.

Conclusion

Our analysis of CPS data for 1978 to 1987 has shown that the human capital method, as applied in a manner similar to that of other analyses, has consistently yielded estimates of the pay gap that differ substantially from those produced by the Pay Agent for the same period. This finding is consistent with the findings of the other academic researchers whose work we reviewed in the previous chapter. Our analysis also shows that the position comparison and human capital methodologies agree that federal pay compared to private sector pay has declined over the same period.

Our analysis of CPS data for the years 1978, 1982, and 1987 shows the significance of the two factors we identified. We found substantial narrowing of the differences between the position comparison and human capital estimates of the pay gap after adjusting for the effect of employer size on earnings. Further, we found a substantially smaller discrepancy in measured pay gaps after adjusting the human capital estimates so that all federal employees were compared to private sector white males. The combined effects of these two adjustments produce human capital estimates of the pay gap that are similar to the official estimates.

Implications of GAO'S Analysis

Our analysis of employer size and employee race and gender as potential explanations of the differences between the results of the position comparison and human capital approaches must be understood within the broader framework of federal personnel management policy. Federal personnel management policy includes such important factors as workforce quality, recruitment and retention, affirmative action, and employee benefits, which may be influenced by the level of pay. Because these factors are beyond the scope of this report, our analysis cannot by itself be used to judge the appropriateness of comparability estimates or the level of federal pay.

Our human capital analysis shows the importance of considering the effect of employer size and employee race and gender on private sector pay when evaluating the two approaches for measuring pay comparability. Further, both the position comparison and the human capital method have limitations in estimating pay gaps.

Position Comparisons and Human Capital Estimates Are Limited in Measuring Pay Comparability

Position comparisons and human capital estimates are different methods for comparing federal and nonfederal pay.[1] Each method has strengths, but each also has weaknesses; neither method is clearly superior. Although annual comparability adjustments are no longer linked to the PATC survey, the Federal Employees Pay Comparability Act calls for locality pay adjustments to the general schedule based on position comparisons. Our analysis contributes to discussions on the strengths and weaknesses of using a position comparison method to compare federal and nonfederal pay.

Position Comparisons

Position comparisons are based on the specific characteristics of a job and the pay associated with such a job rather than on the individual characteristics of the employee in the job. Position comparisons address what other employers pay staff in a specific job. They are used to measure the pay associated with a particular job. To do such a comparison, job descriptions from different employers are matched and the accompanying levels of pay are compared.

Position comparisons are an accepted way for employers to learn what other employers are currently paying employees to perform specific jobs. Many nonfederal employers purchase such information from

[1]There is a difference between comparing salaries and setting salaries. Although both position comparisons and human capital methods are used to compare salaries, we know of no cases where the human capital method is used by employers to set or adjust pay.

compensation consultants and use it for such purposes as setting starting pay, adjusting pay, and determining the competitiveness of compensation. The occupational detail and the number of matched jobs and employees is typically smaller in most applications of the position comparison method than was the case with PATC. To average position comparison data, the Pay Agent blends nonfederal salaries using the federal occupation and pay distribution and arrives at a pay gap for each GS grade level. The official pay gap estimate that has been criticized by some academics is a weighted average of the pay gaps for each GS grade level.

Pay data produced by position comparisons will reflect the nonfederal pay for federal occupations regardless of an employee's race or gender.[2] A position comparison survey like PATC does not distinguish whether a job is being staffed by men, women, whites, or minorities. Thus, the use of a position comparison method will neutralize the effect of race and gender in comparing the salaries of federally employed women and minorities in occupations that are commonly staffed by white males in the private sector.

Most of the pay differences by race and gender within an organization are attributable to the narrowly defined job categories in which individuals are employed. Evidence exists that women and minorities in the private sector are concentrated in lower paying jobs. It is certainly possible that this concentration reflects, at least partly, discrimination. Using position comparison data for such occupations on a job-by-job basis would extend the lower pay for these positions to the federal sector.[3]

Position comparison surveys like PATC tend to reflect the pay level of large employers. Because of the specialization and distinct level of responsibility associated with many federal jobs, position matches for such jobs are more likely to be found in large nonfederal organizations. Once a position match is found, there are likely to be more matching employees employed in any such job when the match is found in a large organization. BLS is now including more small employers in its surveys. These initiatives to increase the representation of small employers have been costly. Also, they have not appreciably affected official pay gap

[2]Although average nonfederal pay varies systematically by race and gender, these differences within the narrowly defined occupations of an employer are relatively small.

[3]Some analysts have argued that this is a moot point because the applicable law requires that federal pay be compared to prevailing private sector pay, as opposed to the pay of white males or any other subset of the private workforce, or hypothetical prevailing pay levels in the absence of discrimination. See Perloff and Wachter, op. cit.

estimates because few position matches were found with the smaller employers surveyed by BLS.[4]

Because position matches are more likely to be found with large employers, using the position comparison method makes it inevitable that the collected pay data will tend to reflect the pay of large nonfederal employers and therefore will be higher than the average nationwide pay. Thus, basing federal pay on position comparisons could make the federal workforce appear to be higher paid in comparison to the nation as a whole.

Position comparisons are only as good as the quality of the job matches and the position descriptions. If the matches are poor or the comparison group is poorly chosen, the survey data on the pay of nonfederal jobs could be misleading. It is equally important to ensure that the position descriptions accurately reflect the duties, responsibilities, and qualifications of the federal employees. Otherwise the comparison by job description will not be valid.

We examined the quality of position matching from past PATC data and reported that the result was accurate.[5] Although there is no guarantee that such accuracy has been maintained, our report indicates that pay surveys based on position comparisons have been conducted effectively by the federal government.

Human Capital Estimates

Human capital estimates link differences in individual employees' pay to common measurable characteristics, such as race, gender, union membership, and federal employment. These estimates also account for individual differences attributable to education and accumulated work experience. This approach is commonly used by many labor economists for studying these kinds of pay differences.

An attractive feature of the human capital approach is that the analyst easily obtains a pay gap estimate without resorting to costly position comparisons. The data that are used to compute human capital estimates have usually been collected for other purposes. Therefore, these data are both widely and inexpensively available. However, little work has been

[4]See Changes to the Methods of Comparing Federal and Private Sector Salaries (GAO/GGD-87-8, May 14, 1987).

[5]See Changes to the Methods of Comparing Federal and Private Sector Salaries (GAO/GGD-87-8, May 14, 1987).

done to answer the question of how representative these data are of nonfederal comparison groups.

By using the human capital approach, the process of estimating the pay gap can be simplified. However, there are data and specification issues that raise concerns as to the applicability of such estimates of the pay gap. Our work in chapter 3 suggests the analysts should exercise caution when they use the empirical results of the human capital estimates to compare pay. We demonstrated that the effect of race and gender on the human capital estimates of the pay gap is sensitive to the choice of the private sector comparison group. The reason for this sensitivity is because privately employed women and minorities tend to be concentrated in lower-paying occupations. In addition, we found that employer size also affects the pay gap.

Human capital estimates of differences in pay between groups, such as between male and female employees or federal and private employees, reflect the average pay for groups of employees that share common measurable characteristics. The appropriateness of using such pay gap estimates for federal paysetting depends on how well these characteristics are measured and on the importance of any unmeasured characteristics. The human capital earnings functions that were estimated for this report attributed approximately 40 percent of the differences in the pay being compared to the following factors: years of education, age, race, gender, employer size, and sector of employment.[6] Although this amount is quite good by academic standards, such results still leave a majority—approximately 60 percent—of the differences in pay unexplained. Much of this difference is attributable to factors, such as ability, intelligence, leadership, and motivation, that analysts are unable to observe directly.

The human capital estimates that we present in this report also reflect the assumption that measured characteristics are equivalent for all groups. An example of such a measured characteristic is the years of schooling. Each year of formal education is counted as a year of schooling and each year is assumed to be equivalent. Pay differences that are due to choice of college major, type of graduate degree, quality of instruction, completion of studies, and academic honors earned are typically ignored. When groups that are being compared in a human capital earnings function differ in

[6]A commonly used measure of how well an econometric model accounts for variations in the data being analyzed is the adjusted R-squared. A typical adjusted R-squared for human capital models is in the neighborhood of 0.4, which implies that approximately 40 percent of the variation in salaries across individuals is explained by the estimated human capital earnings function.

these characteristics, the estimated differences in pay could reflect these differences in the quality of education. For example, if federal and nonfederal employees have advanced degrees from universities and colleges of different quality, then pay differences that are attributed to federal employment may in fact be due to the differences in quality of education.

Also, years of potential work experience are assumed to be equivalent,[7] and the human capital model assumes that average pay grows over time in a similar way for all employees. However, if advancement opportunities are better for some employees, then the relative pay of this group will increase directly with their average age. The pay difference appears largest when we compare individuals at the height of their careers. Any estimated pay difference could then reflect differences that are due to choice of career and labor force participation decisions.

We know of no studies that answer the question of the appropriateness of the nonfederal employees surveyed in CPS—or in other similar data sources—as a comparison group. Only to the extent that the nonfederal group is appropriately comparable will the results of a human capital comparison be useful in determining pay comparability. Ideally, such a comparison group would consist of individuals that the federal government would be willing to hire, drawn from an occupational mix that is comparable to the federal government's. The use of the human capital approach can result in the comparison of nonfederal computer programmers to federal secretaries or federal lawyers to nonfederal librarians. Such a comparison may yield an estimate of relative pay that is partially attributable to differences in the occupational distribution, rather than providing useful information on the comparability of federal and nonfederal pay. As we discussed earlier, other critical characteristics to consider include the type of job, type and quality of education, on-the-job training, career paths, and advancement opportunities.

The position comparison and human capital methods are different methods for comparing federal to nonfederal salaries. The position comparison approach goes to great lengths to ensure the comparability of occupations and then arrives at an overall average that obscures much of

[7]Potential work experience is defined as age in years minus years of education minus the 6 years before the individual started first grade. An additional problem arises when the link between actual and potential work experience varies for groups studied. Potential work experience is greater than actual experience when individuals are both out of work and out of school for long periods of time. Actual experience may exceed the potential for individuals who worked full time while attending college or graduate school.

the detailed information gathered.[8] The human capital approach arrives at an average without the need for the occupational detail but may be sensitive to the choice of nonfederal comparison groups.

Common Limitations of Pay Comparisons

Any method that is used to arrive at a single comparability number is bound to be open to criticism. An appropriate level of compensation cannot be arrived at without considering the consequences for personnel management. In addition, nonpay aspects of compensation, such as fringe benefits, job security, working conditions, advancement opportunities, and on-the-job training, substitute to some degree for purely monetary rewards.[9]

Any method that is used to arrive at a single comparability number cannot be expected to apply with precision to every individual being compared. Any single number is likely to be an average of many differently paid individuals with different skills and responsibilities. The inevitable result of averaging is that individuals on each side of the comparison are paid higher and lower than any one comparability number might suggest.

Both of the methods that we discuss in this report are typically unable to take into account the quantity or quality of employees' work, because no quality or quantity indicators in the compensation data are currently available.

Compensation Levels Are Not Independent of Personnel Management Priorities

The appropriate level of compensation for a job does not exist in a vacuum. Pay and benefits provide not only compensation for services rendered but also incentives for improvements in employee performance. Compensation can be used to attract and retain employees. In addition, pay and benefits serve to some degree as substitutes for each other.

There is no easy answer to the question of the appropriateness of federal general schedule compensation. Any shortcomings of pay gap estimates do not necessarily invalidate the use of such estimates in determining appropriate levels of compensation. Whether there are doubts as to the accuracy of such comparisons, the federal government must consider pay competitiveness in the broader context of federal personnel management

[8]Although the law intends that pay comparability increases be determined separately for each GS level, historically, the practice has been to grant uniform comparability increases for all GS levels.

[9]We discuss attempts to include these nonpay aspects of compensation to arrive at a measure of total compensation comparability in appendix I.

policy. Federal personnel management priorities such as turnover, retention, recruiting, workforce quality, labor market competition, and the achievement of EEO/affirmative action goals are all considerations that are influenced by compensation and have their own implications for the appropriate level of compensation. Critics of the federal pay system sometimes cite one or more of those priorities as evidence that federal compensation is high or low, while ignoring other personnel management priorities. Paysetters and lawmakers need to carefully weigh all aspects of the compensation question when determining the appropriate level of federal compensation. Compensation is considered high or low only in relation to the personnel management goals being considered.

Analyses of Total Compensation Comparability

Many factors, in addition to pay, may affect the success of employers in recruiting and retaining employees. Some of these factors are

- pension benefits;
- health insurance;
- the risk of on-the-job injuries;
- the risk of being laid off;
- vacations, sick leave, and holidays;
- working conditions;
- the inherent ("psychic") satisfaction of the job.

A number of experts in labor market analysis have suggested that federal private compensation comparisons that focus exclusively on pay may be misleading. They have said that systematic differences tend to exist between federal and private sector employment concerning the nonpay conditions of employment.

As an alternative to the principle of pay comparability as it is currently defined and implemented,[1] these experts have suggested that the principle of total compensation comparability (TCC) be implemented. Under the TCC approach, a monetary value for employer-subsidized fringe benefits is imputed for federal and comparable private sector jobs. While these experts recognize that not all differences in job characteristics between the two sectors can be quantified, they think that those elements that can be quantified can capture a substantial portion of the differences between jobs.

We identified several previous attempts to create total compensation measures for the comparison of federal and nonfederal compensation. In this appendix we review these studies, along with evaluations of their analyses.

Office of Personnel Management Study

In the mid-1970s, OPM began a program of research to assess the feasibility of TCC as a basis for setting federal pay. In embarking on this effort, OPM relied heavily on analyses undertaken by actuarial specialists under contract. These analyses were based on data on private sector employee benefit plans gathered by the Bureau of Labor Statistics. A former official of OPM who was heavily involved with this effort told us that it was extremely difficult to perform meaningful comparisons, and that this effort was discontinued.

[1]See appendix II.

Despite the difficulty in comparing benefits between the federal and private sectors, in 1981 the Administration recommended a change in the pay-setting process that was based on the TCC concept. Specifically, the Administration recommended that increases in the general schedule be limited in order to attain a level of pay that is 94 percent of the level of comparability with the private sector, as determined by the results of the PATC survey, rather than the 100-percent target prescribed by the Federal Pay Comparability Act of 1970. In large part this recommendation was based on intangible aspects of federal employment, including the presumed greater employment stability associated with federal employment compared with the private sector, as well as the greater attractiveness of federal nonwage benefits. Further, the 94-percent target was admittedly judgmental. In reviewing this recommendation, GAO found that the justification for this proposal was inadequate.[2]

Congressional Research Service Study

In 1984 the House Post Office and Civil Service Committee published a report on options for the design of a new retirement system for federal civilian employees.[3] This report was largely based on analyses conducted by the Congressional Research Service (CRS), as well as by actuarial consultants under contract to CRS. One segment of this report compared the federal retirement benefits (including survivor and disability benefits) with typical plans in the private sector. The analysts found that federal employees received retirement benefits that were one-third more generous than the most generous private plans.[4]

GAO notes that these computations were based on the package of employee benefits offered to federal employees at that time under the Civil Service Retirement System (CSRS). Although the purpose of the CRS report was to estimate the cost of several alternatives to CSRS, none of the alternatives that were analyzed exactly corresponded to the replacement retirement plan that was finally adopted.

GAO Benefit Comparisons

GAO reported a comparison between federal and private employment with respect to benefits in 1985. GAO presented comparisons between federal and private sector pay and benefits that took into account health

[2]Proposal to Lower the Federal Compensation Comparability Standard Has Not Been Substantiated (FPCD-82-4, Jan. 26, 1982).

[3]U.S. Congress, House Committee on Post Office and Civil Service, Designing a Retirement System for Federal Employees Covered by Social Security, December 1984.

[4]This finding is based on a comparison of employer cost associated with the various plans.

insurance, life insurance, and annual and sick leave and holidays, as well as retirement benefits.[5] GAO found that private employers tended to offer benefits other than retirement benefits that were at least as good as those of the federal government, and, in the case of health and life insurance, were significantly more generous.

National Institute of Standards and Technology Demonstration Project

The National Institute of Standards and Technology, formerly the National Bureau of Standards, is currently conducting a demonstration project testing alternative compensation schemes designed to enhance NIST's flexibility in meeting competition from the private sector for scientists, engineers, and other staff.[6] Among other things, the NIST project had been assessing the feasibility of basing pay on a total compensation comparability principle. However, this aspect of the project was discontinued for budgetary reasons.[7]

[5]Comparison of Federal and Private Sector Pay and Benefits (GAO/GGD-85-72, Sept. 4, 1985).

[6]GAO reported on this project in Federal Workforce: Information on the National Bureau of Standards Personnel Demonstration Project (GAO/GGD-88-59FS, Apr. 5, 1988).

[7]Federal Personnel: Special Authorities Under the Demonstration Project at Commerce (GAO/GGD-92-124BR, July 13, 1992).

Federal Pay Comparability Process

Congress directed BLS to conduct an annual survey of private sector salaries to provide the Pay Agent with data to make annual pay comparability recommendations. For the period covered by our report, BLS responded to this mandate by conducting the National Survey of Professional, Administrative, Technical, and Clerical Pay.

In this appendix, we discuss the process by which pay comparability recommendations are developed, focusing on those features of PATC that are most relevant to this report.[1] We also include information on changes to the paysetting process that have been enacted since the period covered by our review.[2]

PATC Survey of Private Sector Salaries

The initial stage in the pay comparability process involved the collection of private sector pay data. Several steps were involved.[3]

Private Occupations

In administering the pay survey, BLS and OPM developed narrowly defined work levels for selected occupations in the private sector to reflect the same level of work performed in GS grades 1 through 15. PATC survey occupations and work levels were selected on the basis of three criteria. First, an occupation had to be surveyable in private enterprise establishments. Second, it had to be representative of occupational groups that are numerically important in both the federal and private sectors. Finally, a job had to be of essentially the same nature in both sectors. The occupational coverage of PATC was continually revised and expanded over the years. The most recent survey covered 30 occupations and 133 work levels. (See table II.1.)

[1]In 1989, PATC was renamed the White-Collar Pay Survey.

[2]BLS has discontinued the White-Collar Pay Survey. The locality pay data gathering effort combines pay information for private employees with that for state and local government employees. This information is used on a locality basis to measure locality pay gaps.

[3]Unless otherwise noted, the information in this section is taken from U.S. Department of Labor, Bureau of Labor Statistics, National Survey of Professional, Administrative, Technical, and Clerical Pay: Private Workservice Industries, March 1988, Bulletin 2317 (November 1988).

Table II.1: Occupations and Work Levels Surveyed by PATC in 1988

Occupational category	Number of work levels
Professional	
Accountants	6
Attorneys	6
Auditors	4
Chemists	8
Chief accountants	5
Engineers	8
Job analysts	4
Registered nurses	4
Administrative	
Buyers	4
Computer programmers	5
Computer systems analysts	5
Computer systems analyst supervisors/managers	4
Directors of personnel	5
Technical	
Civil engineering technicians	5
Computer operators	6
Drafters	5
Engineering technicians	5
Licensed practical nurses	3
Nursing assistants	4
Photographers	5
Clerical	
Accounting clerks	4
File clerks	3
General clerks	4
Key entry operators	2
Messengers	1
Personnel clerks/assistants	5
Purchasing clerks/assistants	4
Secretaries	5
Stenographers	2
Typists	2

Source: Bureau of Labor Statistics.

GS-Equivalent Levels

PATC was designed to provide salary data for the occupational work levels defined jointly by BLS and OPM. OPM provided the translation into GS-equivalent grades. These definitions were designed to reflect duties and responsibilities of employees in private enterprise that were translatable into the specific GS grades. Table II.2 shows examples of occupational work levels translated into GS-equivalent grades.

Table II.2: Selected GS-Equivalent Grades of PATC Work Levels in 1988

GS-equivalent grades	PATC work levels
GS-7	Accountants II
	Auditors II
	Buyers II
	Chemists II
	Civil engineering technicians IV
	Computer programmers II
	Drafters V
	Engineers II
	Engineering technicians IV
	Medical machine operating technicians IV
	Public accountants
	Personnel clerks/assistants V
	Personnel specialists II
	Photographers III
	Registered nurses I
	Secretaries IV
GS-12	Accountants V
	Attorneys III
	Chemists V
	Chief accountants II
	Computer programmers V
	Computer systems analysts III
	Computer systems analysts supervisors/managers I
	Directors of personnel II
	Engineers V
	Personnel specialists V
	Personnel supervisors/managers II
	Public accountants IV
	Registered nurses IV
GS-15	Attorneys VI
	Chemists VIII
	Chief accountants V
	Computer systems analysts supervisors/managers IV
	Directors of personnel V
	Engineers VIII
	Personnel supervisors/managers V

Source: Bureau of Labor Statistics.

Data Collection

Each year, field economists from BLS who were specially trained in job matching either personally visited or interviewed by telephone approximately 3,500 to 4,000 sample establishments. To match actual jobs in the sample establishments to the survey's occupational work level definitions, the BLS field economists used the employers' organization charts, position descriptions, and other personnel records. For each job match, pay rates were collected for each individual in that position. The collected pay rates were those that were paid to full-time employees for a standard work schedule.

Pay Comparability Recommendations

After the fieldwork was completed, the Pay Agent took several steps to develop a pay comparability recommendation for the president.

GS-Equivalent Averages

The Pay Agent used a set of statistical techniques to arrive at the pay comparability recommendation. The average pay for each GS-equivalent grade was calculated using the median private pay rate for each surveyed work level. There are 14 GS-equivalent grades. These grades range from GS-1 through GS-15, omitting GS-10. To make the calculation, weighting procedures were used to ensure that jobs that are more common within the federal government were given greater weight in the pay comparability process.

Federal Comparability Payline

A curve, called a payline, was then fitted to the 14 data points that resulted from the calculation described above to produce a smooth pattern of pay rates across GS-equivalent grades in the private sector. A payline for the federal sector was similarly fitted to federal median salaries at each grade. Each median GS salary in the federal sector was determined using the actual federal salary distribution. The Pay Agent then calculated the percentage difference between the two paylines at each grade. These percentages reflected the amounts that federal salaries for each grade needed to be adjusted to be comparable with the private sector. In 1989, these calculations resulted in pay increase recommendations that ranged from 20.04 percent at GS-1 to 36.69 at GS-15.

The President's Options

The Pay Agent annually sent a report summarizing the federal private comparability findings to the President. The President had the following two options: proposing a pay adjustment that agreed with the Pay Agent's recommendations or proposing an alternative plan. The President could propose an alternative plan to the Congress if he considered a full comparability pay adjustment inappropriate because of "national emergency or economic conditions affecting the general welfare." The President's alternative plan would become effective unless a majority of

either house of the Congress adopted a disapproving resolution within 30 days of the submission of the President's plan. Each year from 1978 until FEPCA went into effect, the President proposed and the Congress agreed on an alternate pay adjustment that granted increases that were less than those that would have been required for full comparability, as determined by the Pay Agent.

Recent Changes in the Process

The Federal Employees Pay Comparability Act of 1990 changed the paysetting process. The annual governmentwide comparability adjustment is now broken into two parts: national and local comparability. All federal general schedule employees are to receive an annual comparability increase based on the percentage increase in the Employment Cost Index rather than on the presidential recommendation. While the PATC survey no longer has the central pay comparability role, the paysetting process still relies on position comparison information to measure locality pay gaps.

The local portion of the annual pay adjustment varies by geographic area. Eligible federal employees receive a locality pay adjustment.

Under this paysetting process, governmentwide pay increases are now based on the ECI, an index of nonfederal sector labor costs. This ensures that governmentwide pay increases closely follow increases in nonfederal payrolls. Such a process seeks to maintain current gaps rather than to redress past comparability differences.

The locality component of the new paysetting process is designed to address federal nonfederal pay discrepancies. Eligible federal employees receive an additional increase in pay designed to reduce the local pay gap. Locality wage gaps are measured by a position comparison method to determine the amount of any locality adjustment. Partial adjustments (based on a formula specified in the legislation) are accorded eligible employees until the pay gap for their locality becomes sufficiently small.

Current Population Survey

The Bureau of the Census' Current Population Survey is the principal source of official government statistics on employment and unemployment. In addition to monthly labor force data, CPS provides a large amount of detailed and supplementary data. For the monthly survey, households are scientifically selected on the basis of area of residence to represent the nation as a whole as well as individual states and other specified areas. The monthly CPS sample consists of approximately 58,000 households that together contain about 122,000 individuals age 14 and older. The universe is the civilian noninstitutional population of the United States. A probability sample is used in selecting housing units. Each household is interviewed once a month for 4 consecutive months and again for the corresponding period 1 year later. In March of each year, supplemental data are collected for men in the Armed Forces who reside with their families in civilian housing units or on a military base. The March CPS, which is known as the Annual Demographic File (ADF), is also supplemented with a sample of Spanish-speaking households that were identified the previous November. These additions result in the addition of about 2,500 households in the March CPS.

Although the main purpose of CPS is to provide information on employment, an important secondary purpose is to collect demographic information, such as age, race, gender, and level of educational attainment. In addition, questions on income, employer size, and other subjects are included from time to time. ADF contains the basic monthly demographic and labor force data as well as supplemental data on work experience, income, noncash benefits, and migration.

The Survey of Employee Benefits is a May supplement to CPS. At the time we performed our analysis, it had been conducted most recently in May 1988.[1] That supplement provided information on pension and retirement plan coverage, employer size, and other questions asked of all persons employed for pay who had participated in the prior ADF. The supplemental information was matched to ADF to pick up detailed income and demographic information.

[1]The May 1979 supplement was referred to as Pension Plan Data. The May 1983 supplement was named Pension and Retirement Plan Coverage. Although different names have been used for these May supplements, the information collected is similar enough for the purposes of this report.

GAO's Econometric Analysis: Detailed Description and Methodological Considerations

In chapter 3, we presented estimates of the pay gap based on an econometric analysis of CPS data. We analyzed CPS data to determine the potential effects of employer size and employee race and gender on the differences between the federal pay gap estimates that have been reported by the Pay Agent and those derived from a human capital earnings model. Econometric analyses necessarily involve elements of professional judgment. To do our analysis, we had to make a number of methodological decisions concerning such issues as model specification.

In this appendix we review these issues, explain our decisions, and discuss the extent to which our findings are sensitive to the specifications that we adopted. First, we present a detailed description of the human capital earnings function used by labor economists to measure pay gaps. Then, we show how this model is used to calculate the pay gap. Finally, we discuss some of the statistical and methodological problems we encountered.

Human Capital Earnings Model

The human capital approach to earnings implies that annual earnings are mathematically related to an employee's years of formal education and work experience. Stated mathematically, this relationship takes the form of

$$(1)\ \ln Y = \ln Y_0 + b_1 S + b_2 E + b_3 E^2,$$

where Y is annual earnings, Y_0 is the initial earning power of an individual without any work experience or any formal education, S is years of education, E is years of work experience, and the b_is are coefficients reflecting the returns to acquire additional education or work experience.

Equation (1) is generally assumed to hold true for a relatively homogeneous group of individuals. In other cases, certain factors may raise or lower the level of annual earnings. These factors can be allowed for by inserting a dummy variable and a coefficient into the earnings equation as in

$$(2)\ \ln Y = \ln Y_0 + b_1 S + b_2 E + b_3 E^2 + b_4 D,$$

where D is a dummy variable that equals 1 to indicate the presence of some individual characteristic and equals 0 otherwise, and where b_4 is the approximate percentage difference of annual earnings between otherwise identical individuals with the characteristic as opposed to those without the characteristic.

Often, more than one dummy variable is included in equation (2) to account for the many factors other than education and work experience that are associated with differences in earnings. We examined specific characteristics in this report, such as employer size, employee gender and race, and federal employment.

An alternate approach to measuring differences in group earnings using the human capital model is to allow the coefficients associated with work experience and education to differ between groups and to include the dummy variable. A specification such as

$$(3)\ \ln Y = \ln Y_0 + a_1 D + b_1 S + b_2 E + b_3 E^2 + b_{1d} S*D + b_{2d} E*D + b_{3d} E^2*D$$

is equivalent to calculating equation (1) separately for the two demographic groups. This equation can be rewritten as

$$(3a)\ \ln Y = \ln Y_0 + b_1 S + b_2 E + b_3 E^2$$

for the group without the characteristic represented by the dummy variable and

$$(3b)\ \ln Y = \ln Y_0 + a_1 + (b_1+b_{1d})S + (b_2+b_{2d})E + (b_3+b_{3d})E^2$$

for the group with the characteristic. Equations (3a) and (3b) could be used to calculate the estimated mean earnings of the groups. For example, one could calculate (3a) for private sector employees. Then one could use the results to estimate the average earnings for federal employees if they were employed in the private sector. By comparing this calculation to the actual average federal earnings, one can obtain an estimate of the pay gap that is attributable to federal employment.

In labor economics research, both methods are frequently used and generally result in similar estimates of any pay gap.[1]

Estimating the Federal/ Private Pay Gap

We decided to use a simple specification of the human capital earnings equation to focus attention on the investigation of the possible explanations: employer size and employee race and gender. Specifically,

[1]For a further discussion, see Robert Willis, "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions," Handbook of Labor Economics, Volume I, eds. Orley Ashenfelter and Richard Layard (Amsterdam: North-Holland, 1986).

we elected to use the dummy variable method associated with equation (2) above as the method of estimating the pay gap. Our basic specification of the earnings function was

$$(4)\ \ln Y = \ln Y_0 + b_1 S + b_2 E + b_3 E^2 + b_4 D_b + b_5 D_w + b_6 D_f + b_7 D_w D_b$$

where Y is annual earnings, S is years of formal education, E is years of potential work experience, and the D_is are dummy variables that take a value of 1 for black employees, female employees, and federal employees, respectively.[2]

Pay Gap Estimates Implied by the Dummy Variable Methods

In equation (4), the regression coefficient for federal employment is an estimate of the pay gap after making standard adjustments for education, work experience, race, and gender. The pay gap, which we express as a percentage, is assumed to be the same for white males, women, and minorities. The pay gap calculated from the standard version of equation (4) provides a comparison of the average federal employee to the average private sector employee, adjusting for other characteristics.

Because the dependent variable is the natural log of earnings, the maximum likelihood estimate of the proportional pay gap for otherwise identical individuals with any one characteristic in common equals the antilog of the corresponding regression coefficient minus 1. For example, the coefficient on the federal dummy variable in the basic earnings regression for May 1983 is 0.07016124.[3] This implies a federal earnings advantage of exp{0.07016124} - 1 = 0.07268, or a 7.3-percent federal earnings advantage.[4] This procedure was used to generate the estimates of the pay gap in figures 3.1 to 3.3. A complete summary of the pay gaps is provided in table IV.1.

[2]In exploratory regressions, we also included dummy variables for geographic region, urban residence, and broad occupational groups. The addition of these variables had a small and inconsistent effect on the federal coefficient. We decided to drop these variables from the analysis to focus attention on the factors of interest, employer size, and employee race and gender.

[3]See table V.6.

[4]This is the maximum likelihood estimate of the federal/private pay gap. Under the usual statistical assumptions that underlie multiple regression analysis, estimates of the regression coefficients have a normal distribution. Taking the antilog of a normal random variable results in a lognormal random variable. Because of this transformation, the expected value of this estimate of the federal-private pay gap is biased upward by a small amount. To correct this bias, one would need to divide this estimate by the antilog of one-half the variance of the regression coefficient. In practice, estimates of this variance are usually small.

Table IV.1: Human Capital Estimates of the Federal/Private Pay Gap as Measured by the Federal Dummy Variable

Year	Figure 3.1: Pay gap as a percentage of private pay	Figure 3.2: May CPS pay gap estimate	Figure 3.3: Pay gap adjusted for potential employer size effect
1978	15.34%[a]	14.30%[a]	–3.12%
1979	10.95[a]		
1980	12.82[a]		
1981	13.17[a]		
1982	12.11[a]	7.27[a]	–4.72[a]
1983	9.66[a]		
1984	12.55[a]		
1985	11.49[a]		
1986	7.73[a]		
1987	9.26[a]	1.98	–9.04[a]

[a]The underlying regression coefficient is significant at the 5-percent level.

Source: GAO analysis of CPS data.

In order to document the persistent discrepancy between traditional human capital measures of the federal private pay gap and the annual Pay Agent pay comparability measure, we estimated standard human capital earnings functions using CPS cross-sectional data from March 1979 to March 1988. Our primary sample included all full-time employees between the ages of 18 and 65.

The resulting regression estimates were consistent with published academic estimates. We found an earnings premium associated with federal employment that was statistically significantly greater than zero (at the 5-percent significance level) for every year. The size of this premium declined during this time period.

We modified equation (4) to provide the basis for pay gap estimates that are adjusted for employer size and the federal pay of women and minorities. The modifications included adding dummy variables for employer size and sector-specific race and gender dummy variables. We report the exact specifications that we used in appendix V.

For those regressions that adjust for the effect of employer size, the federal dummy variable provides a comparison of the average federal employee with the average employee in a private sector establishment

with over 1,000 employees, after adjusting for other characteristics, such as education and work experience.[5]

For those regressions with sector-specific race- or gender-specific dummy variables, the calculation of the percentage pay gap estimate is more involved. The federal dummy variable in these regressions provides a comparison of the average white male federal employee to the average white male private sector employee, after adjusting for other characteristics such as education and work experience. For other race gender groups, the pay gap relative to private sector white males must be calculated by combining dummy variables, as we describe in the next section. The pay gap is allowed to differ by race and gender and the overall pay gap is a weighted average of the individual gaps.[6]

Relative Federal Earnings Using Private Sector White Males as the Benchmark for Comparison

The pay gap for federal sector white males is calculated using the regression coefficient for federal employees. For the other specific race gender groups, the pay gap is calculated by adding the coefficient for federal employees to the coefficient for the specific race gender group of federal employees. To determine the pay gap for federal sector black males, one would add the coefficient of the dummy variable for federal employment to the coefficient of the dummy variable for black federal sector males. This calculation would give the logarithm of the estimated earnings difference for federal sector black males relative to otherwise identical private sector white males. The overall federal pay gap is then calculated as a weighted average of the federal sector pay gaps where the weights are the percentages of the federal sample made up by each specific race gender group. As example, table IV.2 shows how by using May 1988 data, we calculate a 14.4 percent federal earnings disadvantage.[7]

[5]Not all private establishments that were surveyed in PATC have over 1,000 employees. Given the data that are available in CPS and the lack of information about the exact distribution of employer sizes in PATC, we chose to represent the effect of employer size by comparing federal employees to private sector employees in establishments with over 1,000 employees.

[6]See chapter 2, pp. 24-26, for a discussion of the implications of the choice of private comparison group.

[7]See tables V.12 and V.14.

Table IV.2: An Example of the Calculation of the Pay Gap as a Weighted Average

Step 1:	Co-efficients	Federal white male –0.064	Black federal male –0.046	Black federal female –0.119	White federal female –0.272
Step 2:	Relative log earnings	White male –0.064 –0.064	Black male –0.046 -0.064 –0.110	Black female –0.119 -0.064 –0.183	White female –0.272 -0.064 –0.336
Step 3:	Percentage earnings gap	White male –0.062	Black male –0.104	Black female –0.167	White female –0.285
x	Share in federal workforce	x 0.515 –0.032	x 0.083 –0.009	x 0.092 –0.015	x 0.309 –0.088
Step 4:	Add up weighted gaps	(–0.032)+ =-0.144	(–0.009)+	(–0.015)+	(–0.088)

This procedure was used to generate figures 3.4 and 3.5. The underlying race gender-specific pay gaps and sample proportions for federal employees are listed in table IV.3.

Table IV.3: Data for Federal Private Pay Gaps Calculated as a Weighted Average

Distribution of federal employees by race and gender			
Group	May 1979	May 1983	May 1988
White men	60.67%	53.08%	51.52%
White women	22.73	31.92	30.89
Black men	9.20	8.16	8.35
Black women	7.40	6.84	9.24
Pay gap for specific race gender groups without adjusting for employer size (data used for Fig. 3.4)[a]			
Group	May 1979	May 1983	May 1988
White men	11.33%[b]	0.29%	- 6.21%[b]
White women	–22.53[b]	–25.61[b]	–28.53[b]
Black men	- 0.32[b]	–23.05[b]	–10.44
Black women	–28.04[b]	–25.80[b]	–16.71
Overall	- 0.35	–11.66	–14.43
Pay gap for specific race gender groups after adjusting for employer size (data used for Fig. 3.5)[a]			
Group	May 1979	May 1983	May 1988
White men	- 5.51[b]	–10.81[b]	–16.49%[b]
White women	–34.65[b]	–34.18[b]	–36.71[b]
Black men	–15.77[b]	–31.75[b]	–20.93
Black women	–39.26[b]	–34.38[b]	–26.54
Overall	–15.57	–21.59	–24.04

[a]Differences between groups or over time for one group may not be statistically significant.

[b]The underlying race gender-specific regression coefficient is significantly different from zero at the 5-percent level.

Source: GAO analysis of CPS data.

Data Limitations and Adjustments Made

Analysts must make many decisions when they conduct statistical analyses of survey data. In this section we discuss a number of decisions that we implemented in carrying out our analysis.

Comparability of Time Periods for Annual Earnings

The annual Pay Agent's reports were issued late in the calendar year. For example, the September 1979 Pay Agent's report, which was used for the fiscal year 1980 pay adjustment, was based on private and federal salaries from 1978 and 1979. The earnings data from the March and May supplements to CPS correspond to earnings in the previous calendar year. Continuing our example, we decided to compare the human capital pay

gap estimates using 1979 March or May CPS data with Pay Agent estimates reported later in 1979. Since CPS earnings information reflects annual salaries from 1978, we have labeled this information as 1978 data in our figures.

Work Experience

Because CPS does not directly measure years of work experience, we used a proxy for years of work experience to estimate the human capital earnings functions. We chose a frequently used proxy: substituting potential years of work experience. Potential years of work experience is defined as years of age minus years of schooling minus the 6 years before grade school. While this procedure is widely used[8] it is thought to be a better indicator of actual experience for white males than for women and blacks.

Annual Wage and Salary Information

PATC measures pay as the annual salary for a position, including vacation, holidays, and some overtime but excluding some bonuses and other pay premiums.

The greatest problem that we faced with annual earnings data was that the CPS censored the reported income beyond certain values. While few federal employees would have salary income beyond the cutoff, a consequential fraction of private sector employees did have salaries beyond this cutoff ($100,000 in 1988 for example). Rather than statistically imputing a value to these censored salaries, we chose to understate them by considering their value equal to the cutoff point. In this regard, we may be understating any estimated federal earnings disadvantage.[9]

On the other end of the salary spectrum, the reported salary information for some of the CPS respondents was substantially below that to be expected of someone working 40 hours per week, 50 weeks per year at the minimum wage. This seemed unreasonable to us, and we chose to omit these respondents from the sample rather than to impute an income for them.

[8]See Willis, op. cit.

[9]We experimented with other methods of adjusting for the censoring of annual earnings data in the CPS. We used a tobit estimation technique to predict the value of earnings for those whose earnings were censored. Because there was not enough variation in individual characteristics for individuals censored on income as opposed to those not censored, this technique did not materially affect the regression results.

Additionally, we used the Pareto distribution to impute a mean value for the censored earnings amounts. This resulted in greater estimates of the federal earnings disadvantage.

Weighted Least Squares

We estimated the earnings regressions using weighted least squares for two reasons. First, the CPS is a stratified random sample of the United States, and the sampling weights differ across geographic regions. In cases like this, weighted least squares will lead to consistent estimates. Second, the parameter of interest is the gap in earnings between the two sectors. In calculating the gap, sample proportions for black and white men and women in the federal sector were used to form a weighted average of the race gender-specific pay gaps. Since we chose to use these sampling weights to arrive at the group proportions, we also used these sampling weights to calculate the regression estimates.

May CPS Sample Statistics and Regression Results

In this appendix we provide additional documentation for the econometric analysis that we present in chapter 3 and appendix IV. First, we define the variables that we used to estimate the earnings functions. Second, we present the results of several regressions that we estimated using CPS data collected in 1979, 1983, and 1988. Finally, we present sample statistics for the variables that are used in the several regression equations.

Table V.1: Variable Names and Descriptions

Variable name	Description
Log of earnings	The natural logarithm of the previous calendar year earnings.
Education	The number of years of formal education completed.
Experience	The number of years of potential work experience.
Experience[b]	The square of years of potential work experience.
Black	A dummy variable equal to one if the respondent is black and zero otherwise.
Black female	A dummy variable equal to one if the respondent is a black woman and zero otherwise.
Female	A dummy variable equal to one if the respondent is a woman and zero otherwise.
Federal	A dummy variable equal to one if the respondent is a federal employee and zero otherwise.
FS dummy	A dummy variable equal to one if the respondent did not respond to the establishment size question and zero otherwise.
FG dummy	A dummy variable equal to one if the respondent did not respond to both the establishment size question and the firm size question and zero otherwise.
GS dummy	A dummy variable equal to one if the respondent did not respond to the firm size question and zero otherwise.
Firm size 1	A dummy variable equal to one if the respondent works in a private establishment of 24 employees or fewer and zero otherwise.
Firm size 2	A dummy variable equal to one if the respondent works in a private establishment of between 25 and 99 employees and zero otherwise.
Firm size 3	A dummy variable equal to one if the respondent works in a private establishment of between 100 and 499 employees and zero otherwise.
Firm size 4	A dummy variable equal to one if the respondent works in a private establishment of between 500 and 999 employees and zero otherwise.
Company size 1	A dummy variable equal to one if the respondent works for a private multi-establishment employer with fewer than 25 employees at all locations and zero otherwise.

(continued)

Variable name	Description
Company size 2	A dummy variable equal to one if the respondent works for a private multi-establishment employer with a total of between 25 and 99 employees at all locations and zero otherwise.[a]
Company size 3	A dummy variable equal to one if the respondent works for a private multi-establishment employer with a total of between 100 and 499 employees at all locations and zero otherwise.[b]
Company size 4	A dummy variable equal to one if the respondent works for a private multi-establishment employer with a total of between 500 and 999 employees at all locations and zero otherwise.[c]
Black federal male	A dummy variable equal to one if the respondent is a black male federal employee and zero otherwise.
Black federal female	A dummy variable equal to one if the respondent is a black female federal employee and zero otherwise.
White federal female	A dummy variable equal to one if the respondent is a white female federal employee and zero otherwise.
Black private male	A dummy variable equal to one if the respondent is a black male private employee and zero otherwise.
Black private female	A dummy variable equal to one if the respondent is a black female private employee and zero otherwise.
White private female	A dummy variable equal to one if the respondent is a white female private employee and zero otherwise.
Intercept	The intercept for the regression.

[a]For regressions using the 1988 May CPS, this dummy variable equals one if the establishment size was between 25 and 49 employees.

[b]For regressions using the 1988 May CPS, this dummy variable equals one if the establishment size was between 50 and 99 employees.

[c]For regressions using the 1988 May CPS, this dummy variable equals one if the establishment size was between 100 and 249 employees.

Table V.2: Basic Earnings Regression for May 1979

Variable	Coefficient	T statistic
Intercept	8.419	386.34
Education	0.066	45.70
Experience	0.035	33.44
Experience^2	–0.001	–23.82
Black	–0.149	–9.46
Black female	0.110	4.28
Female	–0.441	–54.61
Federal	0.134	8.96
Sample size		11,611
Adjusted R-squared		0.3893

Source: GAO analysis of May 1979 CPS data.

Table V.3: May 1979 Earnings Regression Adjusted for Employer Size

Variable	Coefficient	T statistic
Intercept	8.670	364.42
Education	0.061	43.20
Experience	0.033	32.48
Experience^2	–0.001	–23.05
Black	–0.159	–10.35
Black female	0.104	4.17
Female	–0.437	–55.60
Federal	–0.032	–1.90
FS dummy	0.065	0.65
FG dummy	–0.189	–12.24
GS dummy	–0.129	–10.01
Firm size 1	–0.139	–9.21
Firm size 2	–0.105	–7.33
Firm size 3	–0.126	–9.42
Firm size 4	–0.085	–4.98
Company size 1	–0.166	–11.08
Company size 2	–0.129	–8.87
Company size 3	–0.057	–4.19
Company size 4	–0.029	–1.48
Sample size		11,161
Adjusted R-squared		0.4249

Source: GAO analysis of May 1979 CPS data.

Table V.4: May 1979 Earnings Regression With Sector-Specific Race and Gender Dummies

Variable	Coefficient	T statistic
Intercept	8.419	386.24
Education	0.066	45.76
Experience	0.035	33.48
Experience^2	–0.001	–23.84
Black federal male	–0.111	–2.19
Black federal female	–0.436	–7.87
White federal female	–0.363	–10.34
Black private male	–0.153	–9.17
Black private female	–0.485	–22.98
White private female	–0.445	–53.70
Federal	0.107	5.64
Sample size		11,611
Adjusted R-squared		0.3894

Source: GAO analysis of May 1979 CPS data.

Table V.5: May 1979 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects

Variable	Coefficient	T statistic
Intercept	8.670	364.29
Education	0.061	43.24
Experience	0.033	32.51
Experience^2	–0.001	–23.06
Black federal male	–0.115	–2.35
Black federal female	–0.442	–8.21
White federal female	–0.369	–10.84
Black private male	–0.163	–10.06
Black private female	–0.498	–24.25
White private female	–0.441	–54.60
Federal	–0.057	–2.80
FS dummy	0.066	0.66
FG dummy	–0.189	–12.21
GS dummy	–0.129	–9.97
Firm size 1	–0.139	–9.23
Firm size 2	–0.105	–7.34
Firm size 3	–0.126	–9.41
Firm size 4	–0.085	–4.97
Company size 1	–0.165	–11.05
Company size 2	–0.129	–8.85
Company size 3	–0.056	–4.17
Company size 4	–0.028	–1.46
Sample size		11,611
Adjusted R-squared		0.4250

Source: GAO analysis of May 1979 CPS data.

Table V.6: Basic Earnings Regression for May 1983

Variable	Coefficient	T statistic
Intercept	8.499	219.50
Education	0.087	37.51
Experience	0.038	23.46
Experience^2	–0.001	–16.36
Black	–0.261	–8.60
Black female	0.235	5.74
Female	–0.455	–41.90
Federal	0.070	3.73
Sample size		7,066
Adjusted R-squared		0.4498

Source: GAO analysis of May 1983 CPS data.

Table V.7: May 1983 Earnings Regression Adjusted for Employer Size

Variable	Coefficient	T statistic
Intercept	8.684	207.64
Education	0.084	36.08
Experience	0.037	23.13
Experience^2	–0.001	–16.11
Black	–0.278	–9.28
Black female	0.235	5.84
Female	–0.453	–42.23
Federal	–0.048	–2.17
FS dummy	0.243	1.22
FG dummy	–0.039	–1.56
GS dummy	–0.093	–4.23
Firm size 1	–0.154	–7.29
Firm size 2	–0.109	–5.33
Firm size 3	–0.082	–4.28
Firm size 4	–0.039	–1.64
Company size 1	–0.086	–4.27
Company size 2	–0.042	–2.06
Company size 3	–0.016	–0.91
Company size 4	–0.009	–0.40
Sample size		7,066
Adjusted R-squared		0.4679

Source: GAO analysis of May 1983 CPS data.

Table V.8: May 1983 Earnings Regression With Sector-Specific Race and Gender Dummies

Variable	Coefficient	T statistic
Intercept	8.506	219.75
Education	0.087	37.49
Experience	0.038	23.51
Experience^2	–0.001	–16.40
Black federal male	–0.265	–3.94
Black federal female	–0.301	–4.15
White federal female	–0.299	–7.45
Black private male	–0.248	–7.28
Black private female	–0.507	–17.02
White private female	–0.466	–41.65
Federal	0.003	0.12
Sample size		7,066
Adjusted R-squared		0.4512

Source: GAO analysis of May 1983 CPS data.

Table V.9: May 1983 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects

Variable	Coefficient	T statistic
Intercept	8.690	207.89
Education	0.083	36.06
Experience	0.037	23.19
Experience^2	–0.001	–16.14
Black federal male	–0.268	–4.05
Black federal female	–0.307	–4.30
White federal female	–0.304	–7.70
Black private male	–0.269	–8.00
Black private female	–0.524	–17.81
White private female	–0.464	–41.93
Federal	–0.114	–4.08
FS dummy	0.247	1.25
FG dummy	–0.039	–1.58
GS dummy	–0.092	–4.17
Firm size 1	–0.154	–7.28
Firm size 2	–0.109	–5.31
Firm size 3	–0.080	–4.23
Firm size 4	–0.038	–1.58
Company size 1	–0.086	–4.26
Company size 2	–0.042	–2.04
Company size 3	–0.016	–0.90
Company size 4	–0.009	–0.38
Sample size		7,066
Adjusted R-squared		0.4693

Source: GAO analysis of May 1983 CPS data.

Table V.10: Basic Earnings Regression for May 1988

Variable	Coefficient	T statistic
Intercept	8.532	212.19
Education	0.096	39.40
Experience	0.041	24.17
Experience^2	–0.001	–17.58
Black	–0.190	–5.93
Black female	0.206	5.04
Female	–0.404	–36.71
Federal	0.020	0.95
Sample size		7,013
Adjusted R-squared		0.4158

Source: GAO analysis of May 1988 CPS data.

Table V.11: May 1988 Earnings Regression Adjusted for Employer Size

Variable	Coefficient	T statistic
Intercept	8.758	210.09
Education	0.089	37.33
Experience	0.039	23.43
Experience^2	–0.001	–16.90
Black	–0.202	–6.46
Black female	0.180	4.50
Female	–0.403	–37.44
Federal	–0.095	–4.38
FS dummy	–0.018	–0.29
FG dummy	–0.193	–6.11
GS dummy	–0.135	–5.17
Firm size 1	–0.169	–9.41
Firm size 2	–0.066	–3.27
Firm size 3	–0.084	–4.11
Firm size 4	–0.103	–5.59
Company size 1	–0.102	–5.00
Company size 2	–0.054	–2.80
Company size 3	–0.029	–1.60
Company size 4	–0.035	–1.25
Sample size		7,013
Adjusted R-squared		0.4431

Source: GAO analysis of May 1988 CPS data.

Table V.12: May 1988 Earnings Regression With Sector-Specific Race and Gender Dummies

Variable	Coefficient	T statistic
Intercept	8.539	212.34
Education	0.095	39.43
Experience	0.041	24.17
Experience^2	–0.001	–17.58
Black federal male	–0.046	–0.63
Black federal female	–0.119	–1.69
White federal female	–0.272	–6.07
Black private male	–0.213	–5.99
Black private female	–0.426	–15.28
White private female	–0.413	–36.51
Federal	–0.064	–2.25
Sample size		7,013
Adjusted R-squared		0.4174

Source: GAO analysis of May 1988 CPS data.

Table V.13: May 1988 Earnings Regression Adjusted for Race, Gender, and Employer Size Effects

Variable	Coefficient	T statistic
Intercept	8.766	210.36
Education	0.089	37.37
Experience	0.039	23.44
Experience^2	–0.001	–16.90
Black federal male	–0.055	–0.76
Black federal female	–0.128	–1.87
White federal female	–0.277	–6.34
Black private male	–0.227	–6.52
Black private female	–0.469	–17.10
White private female	–0.412	–37.22
Federal	–0.180	–6.23
FS dummy	–0.013	–0.20
FG dummy	–0.190	–6.04
GS dummy	–0.134	–5.13
Firm size 1	–0.170	–9.48
Firm size 2	–0.067	–3.32
Firm Size 3	–0.084	–4.14
Firm Size 4	–0.103	–5.61
Company size 1	–0.103	–5.04
Company size 2	–0.056	–2.88
Company size 3	–0.030	–1.65
Company size 4	–0.036	–1.28
Sample size		7,013
Adjusted R-squared		0.4449

Source: GAO analysis of May 1988 CPS data.

Table V.14: Sample Statistics for Regression Analysis

Variable	1979 Mean	1983 Mean	1988 Mean
Log of earnings	9.478	9.926	10.093
Education	12.491	14.002	14.064
Experience	19.484	18.629	17.668
Experience^2	552.294	490.577	435.491
Black	0.090	0.063	0.070
Black female	0.034	0.035	0.043
Female	0.314	0.447	0.498
Federal	0.062	0.077	0.067
FS dummy	0.001	0.001	0.007
FG dummy	0.079	0.056	0.028
GS dummy	0.106	0.062	0.042
Firm size 1	0.273	0.288	0.282
Firm size 2	0.192	0.191	0.118
Firm size 3	0.189	0.189	0.097
Firm size 4	0.064	0.069	0.122
Company size 1	0.163	0.169	0.147
Company size 2	0.108	0.104	0.118
Company size 3	0.102	0.117	0.112
Company size 4	0.038	0.053	0.034
Black federal male	0.006	0.006	0.006
Black federal female	0.050	0.005	0.006
White federal female	0.014	0.025	0.021
Black private male	0.050	0.022	0.022
Black private female	0.030	0.030	0.037
White private female	0.265	0.387	0.434

Source: GAO analysis of May 1979, May 1983, and May 1988 CPS data.

Comments From the Bureau of Labor Statistics

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

U. S. Department of Labor

Commissioner for
Bureau of Labor Statistics
Washington, D.C. 20212

JAN 31 1994

Mr. James R. White
Acting Chief Economist
General Accounting Office
Washington, D.C. 20548

Dear Mr. White,

Thank you for the opportunity to comment on your draft report, FEDERAL PERSONNEL: Federal-Private Pay Comparisons (GAO/OCE-94-1).

I would first like to comment generally on the methodology used in your analysis. The report as drafted uses the earnings of white men in the private sector as a benchmark for evaluating the pay of white women, black men, and black women in the federal government. This is a defensible comparison provided that one is willing to assume that all of the differences in earnings between race/gender groups observed in the private sector (other observable factors held constant) result from discrimination against blacks and women. The report's conclusion that "federal earnings attainment of women and minorities explains part of (the) discrepancy in pay gap estimates" also hinges on much of the private sector discrimination against blacks and women taking the form of their being assigned to less-highly-compensated detailed occupations, rather than their being paid less than white men in the same detailed occupations, and on such discrimination against blacks and women being less prevalent in the federal government. All of this should be discussed explicitly. Otherwise, readers are likely to find the second section of the report quite confusing.

In addition, some readers may be skeptical that private sector race/gender earnings differences reflect only discrimination. If one believed that these earnings differences reflected only productivity differences, there would be no obvious argument for modifying the standard human capital calculation of federal/private pay differentials in the fashion described in the draft report. The analysis might better be described as an attempt to bound the potential contribution of private sector discrimination against blacks and women as a factor in explaining the discrepancies between different methods of measuring the federal-private sector pay gap.

See comment 1.

The report also does not consider differences in the occupational composition of the federal and private sectors. Sales workers are virtually nonexistent in the federal government but are employed in large numbers in the private sector. Adjusting the analysis to remove sales workers might help to explain differences between the Pay Agent's calculations and those derived from the Current Population Survey.

See comment 2.

See comment 3.

Mr. James R. White--2

JAN 31 1994

I would also like to offer some clarifications on a few specific details of the report regarding the Bureau of Labor Statistics (BLS) Occupational Compensation Survey program:

Now on p. 2.
See comment 4.

Page 4: The National Survey of Professional, Administrative, Technical, and Clerical Pay (PATC) provided median and middle-range wage data and a classified distribution of wage rates, in addition to averages.

Now on p. 2 and p. 21.
See comment 5.

Page 4 and Page 33: The PATC survey provided pay rates for a variety of private industry occupations; it did not compare private pay rates with those of federal workers. Comparisons were prepared by the President's Pay Agent using additional data such as federal employment distributions and pay rates. Thus, the pay comparisons should not be attributed directly to the PATC survey.

Now on p. 49.
See comment 6.

Page 70: In 1989, the PATC survey was renamed the White-Collar Pay Survey. The White Collar Pay Survey was also conducted in 1990. The last PATC survey was conducted in 1988 and covered 30 occupations and 133 work-levels.

Now on p. 50.
See comment 7.

Page 71: Chemists included eight work-levels, chief accountants included five levels, and directors of personnel included five levels. Since only nonservice industries were studied in 1988, public accountants and medical machine operating technicians were not studied.

Now on p. 51.
See comment 8.

Page 72-73: The translation of PATC survey jobs to federal general schedule equivalent grades is the responsibility of the Office of Personnel Management. The 1988 survey did not provide data on personnel specialists, which are listed on page 73.

Now on p. 53.
See comment 9.

Page 74: Not all sample establishments were personally visited by BLS field economists. Data for some establishments were collected by telephone interviews.

Please let me know if we can be of any further assistance as you finalize the report.

Sincerely yours,

Katharine Abraham

KATHARINE G. ABRAHAM
Commissioner

The following is GAO's comments on the Bureau of Labor Statistics letter dated January 31, 1994.

GAO Comments

1. We are in general agreement with this interpretation of our analysis. We have expanded the text on pages 26 through 28 in response to these comments.

2. We agree that we do not explicitly model differences in the occupational composition of the federal and private sector in our human capital earnings functions. However, we do discuss the importance of occupational differences in the two sectors on pages 5, 6, 26, and 27.

3. We agree that removing sales workers might have some effect on our analysis. Undoubtedly, private white-collar occupations were included that are not represented in the federal government, just as federal occupations were included that are not represented in the private sector. Although examining federal and private occupations in the CPS for comparability may be valuable, such an exercise is beyond the scope of this report.

4. We have modified the text on page 2 in response to this comment.

5. We have modified the text on pages 2 and 21 in response to this comment.

6. We have added a footnote on page 49 in response to this comment.

7. We have modified the information provided on page 50 in response to this comment.

8. We have modified the text on page 51 in response to this comment.

9. We have modified the text on page 53 in response to this comment.

Comments From the Office of Personnel Management

UNITED STATES
OFFICE OF PERSONNEL MANAGEMENT
WASHINGTON, D.C. 20415

OFFICE OF THE DIRECTOR

FEB - 3 1994

Mr. James R. White
Acting Chief Economist
Office of the Chief Economist
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. White:

Thank you for the opportunity to review the draft GAO report entitled: FEDERAL PERSONNEL: Federal-Private Pay Comparisons. I have no objection to release of the report.

I found GAO's analysis and explanation of the pay differences between "position-based" gap estimates and human capital estimates to be very thoughtful and useful.

Sincerely,

James B. King
Director

Major Contributors to This Report

Timothy J. Carr, Project Director, (202) 512-4083
Gene G. Kuehneman, Jr., Project Manager
Yesook S. Merrill, Senior Economist
Paula J. Bonin, Computer Systems Analyst