

LABOR TURNOVER IN THE U.S. FEDERAL BUREAUCRACY

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This paper presents an empirical analysis of labor turnover in the U.S. federal bureaucracy. The results indicate that job experience in politically important federal agencies is valued by the private sector. Hence (high-level) bureaucrats employed in these agencies have high turnover probabilities. The analysis also shows that equalization of federal sector and private sector wage rates would lead to a relatively small increase in turnover, but to substantial savings in federal payroll costs.

1. Introduction

The study of personnel policies in the U.S. federal government's bureaucracy raises many interesting questions. For example, the empirical analysis of Smith (1977) and Lazear (1980) focuses on the issue of wage comparability between federal bureaucrats and private sector workers. Their studies provide convincing evidence that the wage rates of federal bureaucrats are 10–20 percent higher than the wage rates of equally skilled workers in the private sector. A second set of questions analyzed in the literature concerns the role of political factors in the determination of employment and wage policy by the federal government.¹ Recent studies by Borjas (1980, 1982) show that: (a) the wage rates of bureaucrats in politically important agencies exceed the wage rates of equally skilled bureaucrats in other agencies; and (b) the employment of blacks and women in federal agencies is responsive to political pressures so that, for example, black bureaucrats have higher relative wage rates in agencies with predominantly black constituencies and in agencies which 'produce' affirmative action programs to be enforced in the private sector. These studies, therefore, suggest that an understanding of political factors provides a consistent (and interesting) view of how the federal government hires, places, and promotes federal bureaucrats.

This paper extends previous work by analyzing the determinants of labor turnover in federal agencies. The study of turnover is useful since it implicitly

¹For discussions of how political factors are likely to affect public sector employment policies, see Barro (1973), Ehrenberg (1973), and Becker and Stigler (1974).

combines the two research questions described above. That is, in order to understand labor mobility out of the federal government, it is crucial to know not only the individual's wage rate in the federal agency but also his available opportunities in the private sector. Thus, both the private/federal sector wage differential and the inter-agency wage differences are likely to play an important role in the determination of labor turnover in the federal bureaucracy.

Moreover, it may also be that federal employment serves as a springboard to better job opportunities in the private sector. For example, in the months following Congressional or Presidential elections newspaper articles are often filled with accounts of unemployed federal bureaucrats jumping over to related jobs in the private sector. The empirical analysis below will test the hypothesis of whether federal job experience increases the individual's productivity in private sector jobs. The study will reveal that high wage bureaucrats in 'politically important' agencies do find attractive opportunities in the private sector, and are therefore characterized by high turnover probabilities.

Section 2 presents a brief framework for the analysis. Section 3 discusses the basic empirical results using a random sample from personnel records of federal bureaucrats. Section 4 extends the empirical analysis by considering how adjustments in federal pay (such as the elimination of the private/federal sector wage differential) would affect turnover rates in federal agencies. Finally, section 5 summarizes the main results of the study.

2. Framework

The analysis of the determinants of labor turnover has received careful study by labor economists in recent years.² In this literature, labor turnover occurs whenever the individual's discounted stream of earnings (or utility in a more general framework) in an alternative job exceeds the discounted stream of earnings in the current job. As noted by Becker, Landes and Michael (1977) and Borjas and Rosen (1980) this decision rule applies both to quits and layoffs. This result follows from viewing labor turnover as the mechanism by which the labor market corrects mismatches between workers and firms. In this context, therefore, a job separation takes place whenever an alternative firm provides a better match (hence a higher productivity) for the worker.³

Suppose individual i is employed in federal agency l . Define G_{il} to be the present value of the earnings stream if individual i chooses to remain a government employee in agency l ; and P_{ii} as the present value of the

²See, for example, Borjas and Rosen (1980) and Jovanovic (1979).

³The empirical results of Borjas and Rosen (1980) provide some supporting evidence for this approach to labor turnover.

earnings stream if the individual chooses to leave federal employment for the private sector.⁴ The value of a private sector job, P_{il} , is indexed by the agency subscript to allow for the possibility that some types of federal job experience may affect job opportunities in the private sector.

The individual's turnover decision depends on the sign of

$$I_{il} = P_{il} - G_{il}. \quad (1)$$

If the index I_{il} is positive, a separation occurs, and if it is negative, the individual will continue his employment at agency l .⁵

This simple framework is useful because it suggests which factors will determine the individual's turnover propensity. For example, the model clearly shows the role played by the individual's wage rate in agency l . Since higher current wage rates, *ceteris paribus*, make private sector employment relatively less attractive, the individual's turnover probability will decline. This obvious implication of the model leads to two important points regarding turnover in the federal bureaucracy. First, since average wage levels in the federal bureaucracy are higher than average wage levels in the private sector, turnover probabilities in the federal government are likely to be low. Secondly, since some agencies have higher wage rates than other agencies, there are likely to be major differences in the turnover probabilities among similarly skilled individuals employed by different federal agencies. In particular, holding private sector opportunities constant, turnover rates from the agencies with the highest (standardized for skill) wage rates will be relatively small.

However, it is important to note that the same factors which lead to wage differences among federal agencies are likely to affect private sector opportunities as measured by P_{il} . In particular, Borjas (1980) hypothesizes and presents empirical evidence showing that if the federal government is viewed as a vote-maximizing entity, there exist incentives for the government to select different wage/employment packages for the various agencies. That is, if political support is 'purchased' from constituents by providing them with the agency's output, the government will find it optimal to ensure that the demands of politically powerful constituencies are satisfied. One way of achieving this outcome is by buying the cooperation (or effort) of the bureaucrats employed in these politically sensitive agencies through a higher wage rate.

⁴Note that the analysis ignores two possibilities for turnover: inter-agency transfers and movements from the government to the household sector. Both these issues will be considered in the empirical work below. Also, the 'private' sector is composed of all non-federal jobs: thus, it includes state and local government employment.

⁵The decision rule given by (1), of course, must be net of both the psychic and pecuniary costs of labor turnover.

The constituents, in turn, know that in order to receive substantial federal benefits they must form a politically cohesive group, and they must be familiar with the decision-making process of the federal government and the particular agency. That is, a constituency can maximize its share of the income redistributed by the federal government by lobbying in the right places and applying the political pressure on the appropriate officials. Since former federal bureaucrats are likely to know the operations of the federal agency in more detail than other individuals, the constituency's demand for the agency's output implies that job experience in the agency will be particularly valued by the industries or firms represented in the constituency. Thus, federal job experience in agency l may have an effect on private sector job opportunities as measured by P_{il} .

Of course, it should be clear that not all federal agencies are likely to increase equally the bureaucrat's private sector productivity. Similarly, it is also possible that not all individuals within the federal agency benefit equally from federal job experience. The hypothesis does imply, however, that some individuals (presumably the management-level bureaucrats) employed by certain federal agencies (presumably agencies which are politically favored due to the political power of the constituencies) will have relatively good opportunities in certain segments of the private sector and will, therefore, have higher turnover probabilities.

In order to test these predictions, the decision rule in (1) must be operationalized in terms of observable variables since neither P_{il} nor G_{il} is easily available. Moreover, the concept of a 'politically powerful' agency or constituency must be quantified. Previous work by Borjas (1980) has shown that there exists a very strong positive correlation between the political support generated by an agency's constituency and the wage rate of bureaucrats employed by that agency. This suggests that one possible definition of the political importance of agency l is its standardized wage, \hat{w}_l , where \hat{w}_l is the wage rate an individual with a *fixed* set of skills would earn if employed in agency l . Clearly, the variation in \hat{w}_l across federal agencies would capture the wage differences (presumably created by political factors) among equally skilled individuals employed by different agencies in the federal government. If bureaucrat i 's current wage rate is given by w_i , and if the bureaucrat's socioeconomic characteristics are summarized by the vector X_i , the index measuring the incentives for leaving federal employment can be written as

$$I_{il} = X_i \beta_0 + \beta_1 \ln w_i + \beta_2 \ln \hat{w}_l + v_i \quad (2)$$

Eq. (2) can easily be estimated by making assumptions about the distribution of the disturbance v_i . For example, if v_i is assumed to be normally distributed

(as will be done below) then the parameters in eq. (2) can be estimated up to a factor of proportionality by using maximum likelihood probit.⁶

The framework presented above can be used to sign the coefficients β_1 and β_2 . In particular, for any given set of socioeconomic characteristics (which presumably affect private sector wage rates), an increase in w_i , holding constant the agency's political value, implies that the individual is doing relatively well, and thus diminishes the gains to labor turnover. Similarly, an increase in the agency's political usefulness (as measured by \hat{w}_i), holding the individuals' current wage constant, implies that private sector opportunities are improved and thus will lead to higher turnover propensities. Therefore the partial effect of \hat{w}_i on turnover isolates the role of the agency's political usefulness by holding constant the (opportunity) costs of leaving the federal agency. If there is a positive correlation between the amount of political support generated by the agency's constituency and the value of a former agency bureaucrat to those constituents (firms) in the private sector, then \hat{w}_i will have an unambiguously positive effect on the individual's turnover probability. If, on the other hand, job experience in a politically important agency does not affect the marginal productivity of an individual employed in certain private sector firms, then \hat{w}_i will have no effect on the separation probability.⁷

Eq. (2) tests the hypothesis that job experience in certain agencies provides a springboard to better private sector jobs. As was noted above, it is likely that only some bureaucrats in these agencies gain from this externality. In particular, the positive effect of \hat{w}_i on separation probabilities is likely to be stronger for bureaucrats with managerial capacities, who are familiar with the agency's decision-making process, and who know the 'right' people that can influence government policy. The easiest way of testing this hypothesis is by expanding (2) to include an interaction between w_i and \hat{w}_i . This interaction term is predicted to be positive since the usefulness of federal job experience in the private sector is presumably higher for the high wage bureaucrats employed in the politically favored agencies.

3. Empirical results

The data used in the analysis is the Central Personnel Data File (CPDF) compiled by the Office of Personnel Management (OPM). The CPDF

⁶It is easy to show that the factor of proportionality is given by $1/\sigma_\epsilon$.

⁷It should be noted that labor market competition would lead to differences in $\ln \hat{w}_i$ across agencies for factors such as the attractiveness of the work environment. The empirical evidence in Borjas (1980) suggests that at least two-thirds of the variance in $\ln \hat{w}_i$ can be attributed to political factors. Moreover, if there were perfect competition for federal jobs, individuals would prefer employment in politically powerful agencies since future private sector opportunities are improved. This increase in supply would lead to lower wage rates in these agencies, and β_2 would be negative. A test of the importance of this hypothesis is, therefore, provided by the sign of β_2 .

contains the personnel records of civilian workers employed by the federal government at the time of the creation of the survey, 31 December 1979, or at any time in the eighteen months prior to the creation of the data. The CPDF used in this paper is composed of a 1 percent random sample from personnel records in the eight largest agencies and of a 10 percent random sample from all other agencies.⁸ By over-sampling the smaller agencies, it is ensured that even the relatively small agencies are represented in the analysis. Each individual record contains personal characteristics of the bureaucrat such as education, race, and sex, and also includes employment information such as agency of employment, annual full-time earnings, and years of government service. The analysis is restricted to the sample of white males classified as permanent, full-time civilian bureaucrats working in the United States. The restriction to the sample of white males simplifies the analysis by avoiding the potential problems created by differing levels of racial and sexual wage discrimination between the federal and private sectors. Moreover, the framework developed in section 2 is applicable only when federal bureaucrats consider opportunities available in alternative labor markets. It may well be that many women leave the federal sector to enter household production.

The determination of turnover status for each individual is complicated by the multitude of codes that OPM uses to classify the different types of separation. As was mentioned above, the CPDF being used in this paper contains the personnel records of individuals who were employed in the federal bureaucracy at any time after July 1978. If these individuals are not employed by the *same* agency as of the time the data was created (December 1979), a separation is defined to occur. The CPDF also gives the reason for the separation: a quit (out of government), a transfer (to another federal agency), retirement, death, disability, etc. Given the data available in the CPDF, it is much easier to identify a separation than to classify it as a 'quit' or a 'layoff'. The underlying problem is that OPM uses over seventy codes to characterize various types of separations. Although the official OPM statistics classify a few of these as quits (out of government), there is little hint in the CPDF as to how to distinguish among the various codes. In this study, for lack of a better alternative, a 'quit' is coded by using the OPM definitions. Furthermore, all white males whose separation was due to death, disability, or retirement are deleted from the sample. This restriction, therefore, implies that the separation measure being used includes (OPM-defined) quits, transfers, and a residual composed of 'layoffs'.

⁸The eight largest agencies are the Departments of Defense, Agriculture, Justice, Health, Education and Welfare, Transportation, Treasury, the Postal Service, and the Veterans Administration. A coding error in the creation of the data led to an 11 percent random sample from the Department of the Interior. It should be noted that some agencies are not represented in the CPDF. These include intelligence agencies and employees in the legislative branch of the government. The only sizable agency omitted from the CPDF is the Tennessee Valley Authority.

The first stage in testing the hypotheses developed above is the calculation of \hat{w}_l , the standardized wage for agency l . To create this variable, a wage-generating equation was estimated within the sample of white males employed in each agency. That is, define the earnings function

$$\ln w_{il} = X_{il}\beta_l + v_{il}, \quad (3)$$

where w_{il} is the annual full-time earnings of individual i in agency l ; X_{il} is a vector describing his socioeconomic characteristics; and v_{il} is a statistical residual.⁹ By using the individual data available in the CPDF, eq. (3) was estimated *within* each agency. This led to estimates of $\hat{\beta}_l$ for the agency, and thus the standardized wage for agency l is defined by

$$\ln \hat{w}_l = \bar{X}\hat{\beta}_l, \quad (4)$$

where \bar{X} is a vector of socioeconomic characteristics describing the average white male employed in the federal bureaucracy.¹⁰ The vector of socioeconomic characteristics, X , includes: educational attainment, years of experience in the federal sector, years of experience in the non-federal sector (defined as age–education–experience in the federal sector–6), region of employment, whether veteran, and whether physically handicapped.¹¹

Clearly, since a requirement for defining (4) is that there are enough observations in the CPDF to allow the estimation of (3) for the agency, the analysis was restricted to the largest 39 federal agencies. This subsample contains over 95 percent of all federal civilian employment covered by the CPDF. Column 1 of table 1 presents the estimated $\ln \hat{w}_l$ for a selected group of federal agencies. These statistics illustrate the sizable standardized wage differentials which exist among federal agencies. For example, the average white male employed in the federal bureaucracy could earn approximately 20 percent higher earnings by moving from the Department of Defense to the Department of Transportation. Of course, the crucial assumption of the analysis [supported by empirical evidence in Borjas (1980)] is that these differences partly reflect factors such as the political support generated by the agency's constituency.

Columns 2 and 3 of table 1 give the average quit and separation probabilities for white men in selected agencies. As with the standardized earnings data, the most striking result is the wide disparity in the mean turnover probability (over an 18 month period) across federal agencies. For

⁹The use of log earnings is suggested by the human capital model of income distribution. For a recent survey see Rosen (1977).

¹⁰Note that the notation $\ln \hat{w}_l$ denotes the predicted log earnings, and not the log of predicted earnings.

¹¹See Borjas (1980) for a discussion of the effect of these variables on the earnings of federal bureaucrats.

Table 1
Summary statistics for selected federal agencies.

Agency	$\ln \hat{w}_i$ (1)	Quit rate (2)	Separation rate (3)
Agriculture	9.9066	0.1167	0.2599
Commerce	10.0345	0.0522	0.0862
Defense	9.9758	0.0459	0.0700
Energy	10.2086	0.0592	0.0871
Environmental Protection Agency	10.0244	0.0587	0.0889
Federal Communications Commission	10.0727	0.0680	0.0777
Federal Deposit Insurance Corporation	10.0759	0.0714	0.0804
General Accounting Office	10.1374	0.0441	0.0676
General Services Administration	9.9552	0.0359	0.1003
Government Printing Office	10.0115	0.0185	0.0444
Health, Education, and Welfare	9.9800	0.0465	0.0791
Housing and Urban Development	10.1438	0.0301	0.0677
Interior	9.9589	0.0410	0.0686
Internal Communications Agency	10.1547	0.0062	0.0617
Justice	10.0809	0.0599	0.0880
Labor	10.2324	0.0554	0.0788
National Aeronautics & Space Administration	10.1209	0.0358	0.0543
National Labor Relations Board	10.2630	0.0517	0.0776
Nuclear Regulatory Commission	10.4378	0.0561	0.0867
Office of Personnel Management	9.9951	0.0280	0.0514
Postal Service	9.8194	0.0035	0.0051
Securities & Exchange Commission	10.0858	0.1165	0.1359
State	9.9961	0.0326	0.0456
Transportation	10.2184	0.0291	0.0388
Treasury	10.0155	0.0703	0.1008
Veterans Administration	9.8719	0.1292	0.2149

example, the quit rate in the Postal Service is 0.35 percent, in Transportation it rises to 2.9 percent, while in Agriculture it is 11.7 percent.

The estimated turnover equations using maximum likelihood probit are given in table 2 for the quit probability and in table 3 for the separation probability. The coefficients of the standardizing socioeconomic variables generally have the 'correct' sign. Consider, for example, column 1 of table 2.

Table 2
 Probit regression on quit probability of white males (number of observations = 25,330).

Variable ^a	Coefficient (1)	<i>t</i>	Coefficient (2)	<i>t</i>	Coefficient (3)	<i>t</i>
<i>CONSTANT</i>	-0.0349	(-0.02)	138.34	(4.88)	139.97	(4.95)
<i>EDUC</i>	0.0428	(5.17)	0.0443	(5.34)	0.0477	(5.65)
<i>PREV</i>	-0.0048	(-0.68)	-0.0060	(-0.85)	-0.0067	(-0.95)
<i>JOB</i>	-0.0381	(-4.63)	-0.0358	(-4.33)	-0.0366	(-4.43)
<i>PREV</i> ²	0.0001	(0.50)	0.0001	(0.54)	0.0001	(0.64)
<i>JOB</i> ²	0.0005	(2.54)	0.0005	(2.31)	0.0005	(2.37)
<i>PREV</i> · <i>JOB</i>	-0.0009	(-2.78)	-0.0009	(-2.67)	-0.0009	(-2.62)
<i>HLTH1</i>	0.0400	(0.57)	0.0396	(0.57)	0.0423	(0.61)
<i>HLTH2</i>	0.1049	(2.33)	0.0951	(2.11)	0.0978	(2.16)
<i>NORTH</i>	-0.2261	(-4.12)	-0.2323	(-4.23)	-0.2477	(-4.47)
<i>MW</i>	-0.1184	(-2.28)	-0.1280	(-2.46)	-0.1370	(-2.62)
<i>SOUTH</i>	-0.1237	(-2.61)	-0.1288	(-2.71)	-0.1436	(-2.99)
<i>WEST</i>	-0.0658	(-1.51)	-0.0765	(-1.74)	-0.0772	(-1.76)
<i>VET</i>	-0.0155	(-0.41)	-0.0199	(-0.53)	-0.0201	(-0.53)
$\ln w_i$	-1.1276	(-19.39)	-15.157	(-5.29)	-15.440	(-5.39)
$\ln \hat{w}_i$	0.9360	(6.29)	-12.836	(-4.55)	-12.998	(-4.62)
$\ln w_i \cdot \ln \hat{w}_i$	—	—	1.3959	(4.89)	1.4233	(5.00)
<i>EMP_i</i>	—	—	—	—	0.1100	(2.23)
-2 ln likelihood	7767.6	—	7744.4	—	7739.4	—
Partial derivatives:						
$\partial q / \partial \ln w_i$	-0.0642	—	-0.0678	—	-0.0667	—
$\partial q / \partial \ln \hat{w}_i$	0.0533	—	0.0683	—	0.0730	—

^aKey to variables: *EDUC*=completed years of schooling; *JOB*=years of tenure of government service; *PREV*=*AGE*-*EDUC*-*JOB*-6; *HLTH1*=1 if handicapped; *HLTH2*=1 if refuses to have handicap status recorded in file; *NORTH*, *MW*, *SOUTH*, *WEST*=1 if resides in Northeast, North-Central, South and West, respectively; *VET*=1 if veteran.

The empirical results reveal that the quit probability declines with federal job experience (*JOB*). The traditional explanation of this effect is that job tenure is correlated with the volume of specific training accumulated by the worker so that, in a sense, there is a better job match between employer and employee. The positive coefficient of the education variable (*EDUC*) implies that holding constant the individual's wage, private sector job opportunities improve for highly educated individuals. Finally, it is of interest to note that federal bureaucrats outside the District of Columbia generally have lower quit probabilities. This finding is revealed by the strong negative effect of the region variables (*NORTH*, *MW*, *SOUTH*, *WEST*; the omitted dummy was the District of Columbia). This result implies that opportunities in the private sector for ex-federal bureaucrats are better in the Washington, D.C. area.

The variables of interest for this study are the individual's annual full-time earnings ($\ln w_i$) and the standardized agency wage ($\ln \hat{w}_i$). As can be seen, $\ln w_i$

Table 3

Probit regressions on separation probability of white males (number of observations = 25,330).

Variable ^a	Coefficient (1)	<i>t</i>	Coefficient (2)	<i>t</i>	Coefficient (3)	<i>t</i>
CONSTANT	4.4697	(3.66)	236.05	(9.53)	235.86	(9.51)
EDUC	0.0419	(6.12)	0.0441	(6.42)	0.0427	(6.14)
PREV	-0.0076	(-1.31)	-0.0101	(-1.72)	-0.0097	(-1.65)
JOB	-0.0512	(-7.71)	-0.0484	(-7.26)	-0.0480	(-7.19)
PREV ²	0.0003	(2.22)	0.0004	(2.38)	0.0003	(2.31)
JOB ²	0.0010	(6.08)	0.0009	(5.73)	0.0009	(5.70)
PREV·JOB	-0.0007	(-2.65)	-0.0006	(-2.37)	-0.0006	(-2.42)
HLTH1	-0.1075	(-1.75)	-0.1084	(-1.76)	-0.1095	(-1.78)
HLTH2	0.0113	(0.29)	0.0070	(0.18)	-0.0077	(-0.20)
NORTH	-0.4119	(-9.08)	-0.4258	(-9.35)	-0.4174	(-9.07)
MW	-0.3343	(-7.60)	-0.3509	(-7.94)	-0.3454	(-7.78)
SOUTH	-0.4052	(-9.98)	-0.4147	(-10.20)	-0.4063	(-9.87)
WEST	-0.2193	(-6.05)	-0.2340	(-6.41)	-0.2325	(-6.37)
VET	0.0002	(0.01)	-0.0062	(-0.20)	-0.0063	(-0.20)
ln w_i	-1.2188	(-24.78)	-24.581	(-9.87)	-24.507	(-9.82)
ln \hat{w}_i	0.6282	(4.92)	-22.431	(-9.10)	-22.411	(-9.08)
ln $w_i \cdot \ln \hat{w}_i$	—	—	2.3255	(9.38)	2.3183	(9.34)
EMP _{<i>t</i>}	—	—	—	—	-0.0531	(-1.25)
-2 ln likelihood	11198.6		11113.8		11112.2	
Partial derivatives:						
$\partial s / \partial \ln w_i$	-0.1205		-0.1263		-0.1263	
$\partial s / \partial \ln \hat{w}_i$	0.0621		0.0903		0.0853	

^aSee table 2 for a description of the variables.

has a strong negative effect on the quit and separation probabilities. This, of course, confirms the expectation that (holding skill characteristics constant) the better off the individual is doing in the federal sector, the lower his propensity for a job change. More interesting is the effect of the agency's standardized wage, $\ln \hat{w}_i$, on the individual's turnover propensity. Since the individual's wage is being held constant, the significantly positive coefficient of $\ln \hat{w}_i$ reveals that bureaucrats employed in politically important agencies quit (and separate) more often than other bureaucrats. The underlying reason for this result is worth stressing. In particular, column 1 of tables 2 and 3 provides strong empirical evidence of the usefulness of federal job experience in some federal agencies when employed in the private sector. The data reveal that federal experience improves private sector job opportunities for individuals employed in agencies with high standardized wage rates. To the extent that the variance in $\ln \hat{w}_i$ is due to inter-agency differences in political factors, the results indicate that politically important agencies serve as a breeding ground for bureaucrats interested in an eventual return to high paying private sector jobs.

Of course, it was argued above that not all bureaucrats benefit equally from employment in these agencies. In particular, it may be that federal job experience is more valuable for high level bureaucrats who can easily make political contacts. To test this hypothesis an interaction between $\ln w_i$ and $\ln \hat{w}_i$ is introduced in column 2 of tables 2 and 3. The significantly positive effect of this interaction indicates that turnover propensities increase for highly paid bureaucrats employed in politically powerful federal agencies. This result suggests that private sector opportunities are particularly improved for these individuals, thus confirming the hypothesis that high level bureaucrats gain most from federal experience.

It is useful at this point to indicate the numerical magnitude of these effects. The bottom panel in tables 2 and 3 presents the partial derivatives of the quit (q) and separation (s) probabilities with respect to the variables $\ln w_i$ and $\ln \hat{w}_i$. These partial derivatives are evaluated at the mean values of the explanatory variables.¹² The remarkable fact about these partial derivatives is that despite the strong statistical significance of the probit coefficients, the numerical effects are relatively small. For example, even a 20 percent cut in the wage rate of federal workers would increase the quit rate (separation rate) by only 1.4 (2.5) percentage points. This fact has important implications which will be discussed below. It is also worth noting that the partial effects of the wage variables is not sensitive to the specification of the probit regression.

One important criticism of these results is that a major factor affecting the turnover decision is being ignored. In particular, if separations are, to a large extent, due to 'mismatches' between firm and worker, as the firm's size increases the possibility of a mismatch declines since the individual can be moved around to other bureaus within the firm. Since the probit regressions in columns 1 and 2 of tables 2 and 3 do not control for the size of the agency, the results may be seriously biased.¹³ The last column of tables 2 and 3 introduces the agency size (as measured by the size of the agency's labor force, EMP_i). The results are mixed. The effect of EMP_i on the quit rate is positive, while the effect on the separation rate is negative and insignificant. The important result, however, is that the partial effects of $\ln w_i$ and $\ln \hat{w}_i$ are not affected by the introduction of agency size as an explanatory variable. Thus, the finding that job experience in some federal

¹²In particular, if the quit probit model is given by $I_i = Z_i\gamma + \varepsilon_i$, the probability of a quit occurring can be written as $q = \Pr[\varepsilon_i > -Z_i\gamma]$. Since ε_i is assumed to be normally distributed, this expression becomes $\Phi[Z_i\gamma/\sigma_\varepsilon]$, where Φ denotes the standard normal distribution function. Thus, for the k th variable in the vector Z , z_k , the partial derivative $\partial q/\partial z_k = (\gamma_k/\sigma_\varepsilon)\phi(Z\gamma/\sigma_\varepsilon)$, where $\gamma_k/\sigma_\varepsilon$ is the probit coefficient of z_k , and ϕ denotes the standard normal density function.

¹³It should be noted that the empirical literature has not reached a consensus regarding the importance of firm size as a determinant of turnover propensities. See Parsons (1977) for a discussion.

agencies for high level bureaucrats expands job opportunities in the private sector is unchanged.

4. Turnover rates and the federal relative wage

The analysis in the previous section focused on the existence of inter-agency wage differentials and the effect of these differentials on labor turnover. As discussed in the introduction, an equally important wage differential which affects turnover is the wage gap between (equally skilled) federal bureaucrats and private sector workers. The work of Smith (1977) and Lazear (1980) suggests that the existence of a sizable wage gap between the federal sector and the private sector raises serious questions regarding the operations of the comparability principle used to set the federal wage level. It could be argued that one justification for the wage differential is that labor turnover raises labor costs (e.g. training of new hires, disruption of the production process, etc.) by substantially more in the federal sector. Thus, to reduce turnover the optimal strategy for the federal government is to choose a point on a wage/turnover schedule which minimizes total labor costs.¹⁴

Of course, this argument is valid if indeed the reductions in turnover costs associated with the relatively higher federal wage exceed the additional payroll costs incurred. Although little data exists measuring the extent of turnover costs, the analysis in the previous section can be extended to calculate the savings resulting from the elimination of the federal/private sector wage differential.

The easiest way of addressing this issue is to estimate what would happen to separation rates in federal agencies if the wages in both sectors were equalized. Since all separations (whether quits, transfers, or layoffs) presumably lead to similar turnover costs, the analysis will be conducted on separations as defined in the previous section. Similarly, from the point of view of the government, it is irrelevant whether the separation leads to a job in the private sector or to household production. Hence, the analysis is no longer restricted to white males, but will be conducted on all sex/race groups. Finally, the calculations will be made under the assumption that the federal wage level is, on the average, 10 percent higher than the private sector wage level.¹⁵ Column 1 of table 4 presents the average separation rate (calculated from the CPDF) for a selected group of 26 federal agencies. Recall that these statistics give the probability that a job separation occurs over the eighteen month period covered by the data. To calculate the additional number of

¹⁴See Pencavel (1972) for a discussion of how firms choose different points along a wage/turnover schedule.

¹⁵In the most recent data set analyzed by Smith (1977, p. 63), the 1975 Current Population Survey, the log wage differential between federal bureaucrats and private sector workers of equal skills was between 0.13 and 0.20, depending on the sex of the workers and on the method of measurement. Thus, the 10 percent figure used in the text is a conservative estimate.

Table 4
Effect on separation rate of 10 percent cut in federal wage.

Agency	Separation rate (1)	$\partial s/\partial \ln w^a$ (2)	Number of additional separations (3)	Salary savings (in millions) (4)	Salary savings per separation (5)
Agriculture	0.290	-0.4814 (-11.54)	5796.1	314.6	54281.5
Commerce	0.103	-0.2232 (-10.78)	939.7	129.3	137567.3
Defense	0.084	-0.2249 (-17.29)	21671.4	2488.0	114803.9
Energy	0.115	-0.1600 (-6.47)	336.0	70.3	209245.4
Environmental Protection Agency	0.099	-0.2509 (-7.10)	348.8	42.4	121586.7
Federal Communications Commission	0.069	-0.2466 (-2.61)	54.3	6.9	127016.1
Federal Deposit Insurance Corporation	0.115	-0.3795 (-4.58)	132.8	10.4	78071.7
General Accounting Office	0.083	-0.2508 (-3.89)	135.4	18.9	139494.6
General Services Administration	0.100	-0.1926 (-9.19)	724.2	91.0	125620.6
Government Printing Office	0.052	-0.1718 (-4.49)	120.3	19.4	161475.1
Health, Education, and Welfare	0.115	-0.2073 (-6.97)	3430.8	419.7	122341.3
Housing and Urban Development	0.097	-0.1592 (-5.46)	278.6	52.6	188976.1
Interior	0.081	-0.2058 (-15.22)	1632.0	216.5	132684.9
International Communications Agency	0.052	-0.2452 (-4.11)	23.0	6.6	285354.5
Justice	0.099	-0.3609 (-6.34)	2017.4	148.0	73367.5
Labor	0.132	-0.2538 (-11.66)	601.5	70.3	116890.2
National Aeronautics & Space Administration	0.104	0.3220 (-12.16)	750.3	89.2	118941.3
National Labor Relations Board	0.080	0.1652 (-1.78)	49.6	9.6	193664.0
Nuclear Regulatory Commission	0.142	-0.3365 (-3.76)	104.3	13.1	125599.2
Office of Personnel Management	0.089	-0.1565 (-3.33)	128.3	20.2	157594.6
Postal Service	0.006	-0.0311 (-2.59)	2048.6	1686.2	823096.9
Securities & Exchange Commission	0.135	-0.2835 (-2.25)	59.5	6.7	112591.9
State	0.067	-0.0599 (-1.66)	141.4	85.4	604139.6
Transportation	0.068	-0.1377 (-4.17)	1005.2	256.1	254781.0
Treasury	0.173	-0.4775 (-12.15)	6374.6	333.3	52290.7
Veterans Administration	0.221	-0.3957 (-12.79)	9255.4	523.4	56555.7

^at-ratios are given in parentheses.

separations resulting from the equalization of the wage rates in the two sectors, a probability of separation equation is estimated *within* each agency. This regression is of the form

$$s_i = X_i\alpha_i + \lambda_i \ln w_i + \mu_i, \quad (5)$$

where s_i is the separation probability for individual i ; X_i is the vector of socioeconomic characteristics described above; and w_i is his full-time annual earnings. Eq. (5) is estimated within each agency using the linear probability model since probit regressions in a few agencies led to very similar results.

Column 2 of table 4 presents the estimated $\hat{\lambda}_i$ for each of the agencies being analyzed. Perhaps the most remarkable finding is again the relatively inelastic response of the agency's separation rate to changes in the wage level of the agency. For example, in the Defense Department the average separation rate is 8.4 percent; a 10 percent wage cut would increase the separation rate to only 10.6 percent.

Given the estimate of $\hat{\lambda}_i$ for the federal agencies, the number of additional separations resulting from a 10 percent wage cut over an eighteen month period can be calculated.¹⁶ This statistic is presented in column 3 of table 4. Its calculation is easily illustrated using the results for Defense. The 10 percent wage cut increased the separation rate by about 2.2 percentage points. Since the Defense Department has approximately 963.6 thousand civilian employees, the results imply that the 10 percent wage cut would lead to an additional 21,671 separations over an eighteen month period.

The next step in the procedure is to estimate the payroll savings of a 10 percent cut in the agency's average wage level (for the eighteen month period). Given the average wage in the agency and the agency's labor force, payroll savings can be easily calculated and are presented in column 4.¹⁷ The magnitude of the savings is quite large for many agencies. For example, in the Defense Department payroll savings approach \$2.5 billion, and even a relatively small agency like the Federal Communications Commission would save about \$7 million in salaries.

Finally, column 5 gives the ratio of column 4 to column 3, or the payroll savings per separation resulting from the 10 percent wage cut. The most surprising result is the very large magnitude of this number. For instance, the Department of Defense would save about \$114,000 for each separation that

¹⁶This is given by $-0.01\hat{\lambda}_i L$, where L is the size of the agency's labor force.

¹⁷The exact computation of column 4 uses the formula

$$\text{column 4} = 1.5[e^{\ln \bar{w}} - e^{(\ln \bar{w} - 0.1)}]L,$$

where $\ln \bar{w}$ = average log earnings in the agency and L is the size of the agency's labor force. Note that this calculation implicitly assumes that all separations occur at the *end* of the eighteen month period. Any other assumption would result in substantially higher payroll savings for the federal government.

occurs as the result of a 10 percent wage cut. The per separation savings in Agriculture are over \$50,000 while in the Postal Service they exceed \$800,000. In other words, equalization of federal/private sector wage rates would lead to significant payroll savings per additional separation from the federal sector. This implies that unless the costs associated with turnover exceed the quantities calculated in column 5 of table 4, wage equalization would lower labor costs in the federal bureaucracy.

Of course, one important question is whether these results can be used to forecast the turnover behavior of the *current* stock of federal bureaucrats. The simulation in table 4 is based on a sample of bureaucrats employed by the federal government between July 1978 and December 1979. It could be argued that some individuals in this sample were characterized by high turnover propensities, and that these individuals are likely not to be currently employed by the government. In a sense, therefore, the current stock of federal workers is a self-selected sample with an over-representation of bureaucrats with low turnover propensities. If this is the case the results in table 4 are *conservative* estimates of the payroll savings per separation since the current stock is likely to contain a large number of 'stayers', individuals with relatively low turnover propensities. However, to the extent that new hires and the filling of vacancies restore the 'randomness' in the current stock, the bias in the estimates of table 4 may be relatively small.

5. Summary

This paper has presented an analysis of labor turnover in the U.S. federal bureaucracy. At the individual level, job mobility decisions are made by comparing the stream of earnings in alternative jobs with the stream of earnings in current jobs. Hence, the study of turnover in the federal bureaucracy presents opportunities to investigate not only how federal wage rates compare to private sector wage rates, but also the consequences of wage differentials among the various agencies in the federal bureaucracy.

The empirical analysis focused on each of these two issues. The major results were as follows.

(1) The separation rate in the federal bureaucracy is relatively inelastic to changes in the federal wage. This implies that the equalization of federal sector wage rates with those found in the private sector would have relatively small effects on turnover, and thus on the costs associated with turnover. On the other hand, it was shown that the payroll savings associated with this reform of the federal wage structure would be significant.

(2) The existence of inter-agency wage differentials (among similarly skilled individuals) was interpreted within the context of a political model. That is, these differences arise because vote-maximizing politicians wish to guarantee

the delivery of federal benefits to politically powerful constituencies. One way of doing this is to purchase the cooperation of bureaucrats employed in these agencies through higher bureaucratic wage rates. It was found that employment in these agencies serves as a springboard to better private sector jobs. In particular, high level bureaucrats employed in politically powerful agencies have higher turnover rates than other bureaucrats.

Clearly, the study of wage and employment policy in the federal bureaucracy is only in the initial stages. The analysis in this paper, however, shows that a complete understanding of labor turnover in the federal bureaucracy requires the introduction of political factors into traditional labor market models. This merging of two different frameworks promises to be an important ingredient in developing insights about the labor economics of the public sector.

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