The empirical analysis focuses on how separation outcomes in the early and mid-career of civil service employees differ for those under FERS compared with those under CSRS. A key result of the simulation analysis in Chapter Three is that FERS embeds weaker separation incentives for those in their early and mid-careers. The goal of the empirical analysis is to examine whether actual separation rates are predicted to be lower for those covered by FERS. In this chapter, we describe the data set we use, some confounding factors in the data analysis, and our empirical approach. The next chapter presents the empirical results.

We examine separation rather than retirement outcomes empirically because no one in the civil service has spent an entire career and retired under FERS. Given that only those who entered since 1984 are covered by FERS, insufficient time has passed. It would be possible to compare the retirement rates of those who spent only a partial career under FERS and under CSRS, but relatively few people have either retired under FERS or have spent a partial career under CSRS.1 In addition, one would need to address possible selection biases that arise from the possibility that those who spend a partial career under FERS or CSRS and retire are not a random group of civil service personnel. Later in this chapter we will discuss how the lack of time under FERS and the implementation of FERS creates some confounding factors in our analysis of separation outcomes.

**DATA**

The data we used are beginning-fiscal-year inventories of DoD civil service personnel from FY82 to FY96 provided by the Defense Manpower Data Center. We limited our data analysis to a subsample of the population. We excluded from the analysis file those individuals who were temporary workers, worked less than full-time, were considered “inactive” employees, or were seasonal. We excluded these individuals because they may have less attachment to the labor force, have higher separation rates, and be disproportionately represented among those covered by FERS. Including them could bias our analysis of separation rates under the two systems. We also

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1Relatively few individuals switched to FERS in the 1980s. For example, in the first FERS transfer program in 1987, the General Accounting Office found only 4 percent switched to FERS (GAO, 1998). Consequently, relatively few individuals are in their late career and covered by FERS.
excluded military technicians because they are covered by a different FERS plan specifically designed for them and because they serve in a uniformed military component as well. Overall, about 20 percent of each annual inventory was deleted. Figure 4.1 shows the total size of the inventory in each year and the inventory size in each year after we made these exclusions.

Given the enormous size of each inventory, even after the exclusions were made, and the amount of time it takes to process these data, we chose to work with a 20 percent random subsample stratified by year. In other words, we randomly selected 20 percent of each annual inventory and merged the subsamples to form one data set. Sampling cuts the size of the data set, net of exclusions, from 12,427,967 observations to 2,485,593.

The data include a wide range of information on each individual including various job characteristics and individual characteristics. The job characteristics include information on occupational area, component (e.g., Army, Navy, Air Force, Marines, or defense agency), pay plan (e.g., general schedule or wage grade), grade, years of service, last performance rating, and supervisor or managerial status. By matching inventories across years, we can determine whether an individual entered the DoD civil service in the past year. By determining which individuals are in the current inventory but were not in the previous year’s inventory, we can indicate which individuals were part of the inflow into the annual DoD inventory. The individual characteristics include gender, race and ethnicity, education, region, veteran’s status, retirement system coverage (e.g., FERS or CSRS), reported handicap status, age, and whether the individual switched to FERS.

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2 As will be discussed later in the text, our analysis will also exclude those covered by other retirement plans, such as CSRS-Offset and CSRS-Interim.

3 The inventories were matched before the 20 percent random samples were drawn.

4 The data do not permit easy identification of new hires versus rehires. First, the YOS variable in our data set includes active duty military service. Consequently, an individual may be a new hire to the civil service but enter with YOS greater than one, indicating that the individual is a veteran. Second, some individuals appear to be rehires or transfers from another federal agency because their YOS are greater than zero at entry and they are not veterans. Yet, these individuals never appear in one of our earlier inventory files. While long gaps in civil service are possible, it is also possible that these individuals are really new hires with a miscoded YOS variable. As discussed later in the text, the YOS variable was somewhat problematic in our data set.

5 The education variable is also problematic in our data set. According to the Defense Manpower Data Center, the education variable in the data set is not always updated when an individual accumulates more education. Nonetheless, the education variable should accurately reflect entry education. Insofar as most individuals do not significantly increase their education over their careers, it is not clear how much of a problem the lack of updating is. Even if many do significantly increase their education over their careers, entry education should provide some control for how separation rates vary by education level. As discussed later in the text, we conduct sensitivity analysis to examine how sensitive our empirical results are to inclusion or exclusion of this variable.

6 We identify each individual’s retirement system coverage using the variable in the data set indicating retirement system. We also checked the years of service variable and fiscal year variable to make sure individuals were not incorrectly coded as being covered by FERS or by CSRS. Individuals for whom system coverage was clearly incorrect were deleted from the data set; however, few observations had this problem. Still, because some individuals were assigned to the wrong retirement system by their agency, our data may indicate an incorrect retirement system for those cases. (See Causer, 1998.)
A key variable in our analysis is whether an individual who was in the beginning-fiscal-year inventory separated during the fiscal year. To construct this variable we matched the annual inventories to determine which individuals in a given fiscal year inventory were no longer in the inventory in the following year. We called these exits. To determine whether the exit was a separation or a retirement, we made use of transaction data provided by the Defense Manpower Data Center. A transaction record is generated whenever an individual leaves the DoD civil service. The transaction record indicates the type of exit that occurred, e.g., involuntary separation, voluntary retirement, and so forth. We consider an exit to be a separation if the individual had a transaction record indicating that a separation occurred. Since there is a nontrivial number of cases in which an exit occurs but there is no transaction record indicating the type of exit, we conducted sensitivity analysis with our definition of separation, including adding the indeterminate exits to the known cases of separations.

One potential problem with our definition of separations is that it is defined relative to DoD and not relative to the civil service. For example, individuals may leave the DoD civil service to work in another civil service agency, such as the Department of Energy. These individuals will appear as separations in our data set. Yet, individuals who transfer between civil service agencies are usually covered by the same retirement system. Technically speaking, the data include a variable that indicates whether the individual is a transfer to or from another civil service agency. However, this variable is highly error-ridden according to the Defense Manpower Data Center. Therefore, our data do not allow us to distinguish accurately between transfers to another agency and separations from the civil service.
Another data quality problem that we confronted in this analysis is that the YOS variable is problematic. Specifically, we linked the annual inventories together by matching scrambled Social Security numbers and found that, in a nontrivial number of cases, the YOS variable did not increment in any sensible fashion. As discussed in Appendix B, we found that most of the problem cases were for personnel who worked for the Air Force in the Air Materiel Command and for those who were veterans. To address this problem, we identified the observations in which YOS were not sequential and excluded them from our analysis. We also did some sensitivity analysis by redoing the analysis and including them in the sample.

CONFOUNDING FACTORS

The manner in which FERS was implemented and the fact that it covers only workers who entered civil service for the first time since 1984 create an “identification problem” in our analysis of separation rates under FERS and CSRS. In this section, we detail to a greater extent how FERS was implemented and how this affects our ability to identify the effect of FERS on the separation rates of early- and mid-career personnel.

As noted earlier, individuals who entered the civil service before 1984 were covered by CSRS. In 1984, it became clear that a new retirement system would be introduced, but the specifics of the new plan had not been determined. Therefore, beginning in 1984, those who entered the civil service were no longer placed under CSRS but, instead, were placed under a plan called CSRS-Interim. This interim system included both CSRS and Social Security coverage. In 1987, when FERS was introduced, new entrants since 1984 were placed automatically under FERS. Reentrants (e.g., those who were rehired after 1984 but were originally covered by CSRS) were also automatically placed under FERS if they had fewer than five YOS. Reentrants with more than five YOS had the option of joining CSRS-Offset, the new name for the CSRS-Interim plan. Existing CSRS-covered employees had the option of switching to FERS between 1987 and 1988. In July 1988, the switching window was closed. It was opened again in July 1990 for six months.

Figure 4.2 shows the fraction of civil service personnel in each annual inventory that is covered by CSRS, CSRS-Interim/Offset, or FERS. FERS coverage rose from about 20 percent in FY88, the first year for which we have data on FERS, to about 50 percent in FY96. Coverage rose as more individuals entered the civil service over time under FERS and as more individuals under CSRS retired or separated.

Because of the way FERS was implemented, e.g., grandfathering existing employees under CSRS with some switching allowed and automatically covering new employees under FERS, the age and YOS distributions of those under FERS and those under CSRS differ markedly. The age distributions for all years in our data set are shown in Figure 4.3, and the YOS distributions are shown in Figure 4.4. Those under FERS are considerably younger and have fewer YOS. For example, the mean YOS in the sample is 17.4 for those under CSRS but is 7.2 for those under FERS. These differences have gotten even starker over time as shown in Figures 4.5 and 4.6 for FY96.
Figure 4.2—Fraction of DoD Civil Service Personnel Under CSRS, FERS, and CSRS-Interim/Offset

Figure 4.3—Age Distribution for Both Systems, All Years
Fraction of employees by Years of Service (YOS) and Age for CSRS and FERS systems.

Figure 4.4—YOS Distribution for Both Systems, All Years

Figure 4.5—Age Distribution for Both Systems, FY96
ample, the average YOS in FY96 of those covered by FERS was 9.7, while it was 22.4 for those covered by CSRS.\footnote{The difference in mean age of those covered by FERS versus those covered by CSRS is less stark in FY96 (Figure 4.5) than in all years combined (Figure 4.3) because the average age of new hires has risen over time in the civil service and the DoD civilian workforce has gotten considerably older overall.}

These differences in the age and YOS distributions of those covered by FERS compared with those by CSRS have implications for our analysis of separation rates. Figure 4.7 shows mean separation rates by year for those covered by CSRS and those covered by FERS. Figure 4.8 shows mean retirement rates by year by retirement system coverage. We find that those covered by FERS have higher average separation rates and lower average retirement rates. However, since younger and more-junior civil service personnel are more likely to separate and less likely to retire in general, those covered by FERS may have higher separation rates and lower retirement rates because of their youth and lack of experience.

This suggests a need to control for age and YOS in our comparisons of separation rates between those covered by FERS and those covered by CSRS. In Figure 4.9 we show mean separation rates by age in FY96. Even controlling for age, we continue to find that those covered by FERS have higher separation rates. In fact, based on the comparison in Figure 4.9, one would conclude that FERS embeds stronger turnover incentives than CSRS for those in their mid-careers. This would be contrary to what our simulation model predicted in Chapter Three. However, the comparison in Figure 4.9 does not control for YOS.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{yos_distribution}
\caption{YOS Distribution for Both Systems, FY96}
\end{figure}
Figure 4.7—Mean Separation Rates by Year for Both Systems

Figure 4.8—Mean Retirement Rates by Year for Both Systems
Because of the way FERS was implemented, controlling for age, YOS, and fiscal year in comparisons of separation rates of those covered by FERS and CSRS is not straightforward. As Figures 4.5 and 4.6 suggest, relatively few individuals who are covered by CSRS are junior enough and relatively few individuals who are covered by FERS are senior enough to be compared with one another in a recent fiscal year. If we exclude those covered by CSRS-Offset, all personnel covered by CSRS in FY96 have at least 12 YOS. If we exclude those who switched to FERS voluntarily, all personnel covered by FERS in FY96 have at most 12 YOS.

Because some switching was allowed in 1987 and 1988, not everyone covered by FERS was automatically placed under this system. If those who chose to switch have characteristics, unrelated to the incentives embedded in FERS, that make them more likely to separate from the civil service, then including them in our analysis could bias our comparison of separation rates under FERS and CSRS. Consequently, we exclude these individuals from our analysis. Excluding these observations exacerbates the problem associated with identifying the effect of FERS on separation rates discussed in the previous paragraph. Only those who switched to FERS have enough YOS or are old enough to be compared with CSRS personnel of similar ages and YOS in a given fiscal year.

For similar reasons, we exclude those covered by CSRS-Interim/Offset from our analysis. Individuals who left the civil service and returned might have characteristics unrelated to the incentives embedded in CSRS that make them more or less likely to separate. Furthermore, their behavior might be affected by their Social Security coverage. Including these personnel could bias our comparison of separation rates under FERS and CSRS. However, excluding these personnel exacerbates the identifi-
cation problem because these personnel are likely to be the only individuals under CSRS who have few enough YOS to be compared with those under FERS in a given fiscal year.

In the next section, we discuss our empirical approach and specifically how we attempt to address the identification problem.

**EMPIRICAL APPROACH**

To address the identification problem, we compare the early- and mid-career separation outcomes of those under FERS in the later fiscal years in our sample, FY89 through FY96, to those of early- and mid-career personnel under CSRS in an early fiscal year in our sample, FY83. In FY83 no one was covered by FERS. In FY89 through FY96, our data include individuals who were covered by either CSRS or FERS. We exclude the years FY84 through FY88 because our data do not indicate which personnel were either covered by FERS or had switched to FERS from CSRS. As an example of the approach, we compare the separation rates among individuals with 12 or fewer YOS in FY96 who are covered by FERS with the separation rates among individuals with 12 or fewer YOS in FY83 who are covered by CSRS. We chose 12 YOS as the cutoff YOS for FY96 because only those who entered since 1984 were automatically covered by FERS.

Of course, any difference in the separation rates of those covered by CSRS in the early 1980s and those covered by FERS in the late 1980s and early 1990s could be unrelated to differences in retirement system coverage and be related to general environmental changes that occurred between these years. For example, individuals in the 1990s may have viewed their career prospective differently in light of the drawdown in the DoD civil service that occurred in 1992 and 1993 and changed their separation behavior relative to individuals in the early 1980s.

To address this issue, we needed to create a control group, namely a group of early- and mid-career civil service personnel who were present in both in the early 1980s and in the late 1980s and early 1990s and who were covered by the same retirement system. Such a control group would allow us to net out differences in separation rates due to differences in fiscal year from our comparison of separation rates under FERS and CSRS. Unfortunately, no such control group exists.

We proxy the control group with a group of senior personnel who were under CSRS in both the early 1980s and the late 1980s and early 1990s. For example, we compare the separation rates among individuals with 24 YOS who were covered by CSRS in FY89 with the separation rates among individuals with 24 YOS who were covered by CSRS in FY83. We assume that any difference in the separation rates between these two groups captures differences related to changes in the general environment be-

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8We do not use FY82 because several variables are missing or do not vary in this inventory, such as geographic region and performance rating. For sensitivity analysis, we rerun the regression using data from FY82 and FY83 but excluding those variables that had missing values or no variation in FY82. We find that our main results are unchanged.
tween these two periods. To identify the effect of FERS on separation rates, we subtract the difference in separation rates in the control group from the difference in separation rates among junior and mid-career civil service personnel covered by FERS compared with those covered by CSRS.

For our proxy control group to be meaningful, we must assume that the effect of environmental changes on separation rates is the same for senior as it is for junior and mid-career personnel. This assumption may be questionable. However, this is the only alternative available. When making major changes to the retirement system in the future, Congress should consider initiating a test concurrent with or prior to the policy change that would create a control group, allowing identification of the effect of the policy.

As discussed previously, our analysis excludes all individuals who were voluntarily switched to FERS. We exclude them from the analysis in two ways. First, we use the variable in the data set indicating a switch to FERS to delete all personnel in the data for whom this variable indicated a switch. Second, we selected personnel on the basis of their YOS. In FY96, we selected only individuals covered by FERS who had 12 or fewer YOS. Since only those entering since 1984 could be automatically covered by FERS, only those with 12 or fewer YOS in FY96 were automatically placed under FERS. In FY95, we selected individuals covered by FERS who had 11 or fewer YOS, and so forth. Finally, for FY89, we selected individuals covered by FERS who had five or fewer YOS. Table 4.1 lists, by fiscal year, the individual covered by FERS who we included in our analysis sample. We compare the separation rates of these individuals with individuals covered by CSRS who have 12 or fewer YOS in FY83. This selection of CSRS personnel in FY83 is also shown in Table 4.1.

Because we use senior personnel covered by CSRS to proxy the control group in our analysis, we needed to include only those senior individuals covered by CSRS who had no incentive to switch to FERS during the open switching period in 1987 and 1988. Otherwise, our group of individuals covered by CSRS would be self-selected, and their presence could introduce a selectivity bias into our analysis. Empirically, we found that no one with 24 YOS or more in FY89 switched to FERS. In our analysis of switching incentives in Chapter Two, we found that individuals who face a switch decision late in their careers have no incentive to switch. Therefore, to form the control group, we chose those individuals covered by CSRS who had 24 or more YOS in FY89, who had 25 or more YOS in FY90, and so forth. In FY96, we chose individuals covered by CSRS who had 31 or more YOS. The selection of CSRS personnel by YOS is also shown in Table 4.1.

Figures 4.10 and 4.11 illustrate an example of the basic approach we use to estimate the effect of FERS on separation rates. As Figure 4.10 shows, we compare the separation rates by age of those with 12 or fewer YOS in FY96 and covered by FERS to the rates by age of those with 12 or fewer YOS in FY83 who were covered by CSRS. In this example, the rates are quite close. Because this comparison might reflect differences in separation rates that are due to changes that occurred in the general environment between FY96 and FY83, we compare the rates in Figure 4.10 to the difference in rates among the control group. The rates for the control group in each fiscal year are
Table 4.1
Years of Service Sample Selection

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Covered by FERS</th>
<th>Covered by CSRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>—</td>
<td>YOS ≤ 12, YOS ≥ 24</td>
</tr>
<tr>
<td>89</td>
<td>YOS ≤ 5</td>
<td>YOS ≥ 24</td>
</tr>
<tr>
<td>90</td>
<td>YOS ≤ 6</td>
<td>YOS ≥ 25</td>
</tr>
<tr>
<td>91</td>
<td>YOS ≤ 7</td>
<td>YOS ≥ 26</td>
</tr>
<tr>
<td>92</td>
<td>YOS ≤ 8</td>
<td>YOS ≥ 27</td>
</tr>
<tr>
<td>93</td>
<td>YOS ≤ 9</td>
<td>YOS ≥ 28</td>
</tr>
<tr>
<td>94</td>
<td>YOS ≤ 10</td>
<td>YOS ≥ 29</td>
</tr>
<tr>
<td>95</td>
<td>YOS ≤ 11</td>
<td>YOS ≥ 30</td>
</tr>
<tr>
<td>96</td>
<td>YOS ≤ 12</td>
<td>YOS ≥ 31</td>
</tr>
</tbody>
</table>

Figure 4.10—Separation Rates by Age When YOS ≤ 12
(CSRS in FY83 and FERS in FY96)

Shown in Figure 4.11. As the figure indicates, the separation rates of those covered by CSRS with 31 or more YOS in FY83 are similar to the ones in FY96.

Because factors other than retirement system or fiscal year can affect separation outcomes, we estimate a reduced form logit model that allows us to control for the effect of some of these other factors. In the logit model, the probability of separating is modeled as a function of a set of covariates where the probability density function is the logistic distribution that we denote as G. The model we estimate is of the following form:

\[
\text{Prob}(S_{it} = 1) = G(a + bF_{it} + cX_{it}) \\
= \exp(a + bF_{it} + cX_{it}) / (1 + \exp(a + bF_{it} + cX_{it}))
\]  (4.1)
Sit equals one if individual i separated in fiscal year t and is equal to zero if he or she did not. The variable Fit represents FERS coverage. If individual i is covered by FERS at time t, the Fit equals one; otherwise it equals zero. The individual’s personal and job characteristics are represented by Xit; a, b, and c are parameters that we estimate. The definition of the variables included in Xit and their means are given in Appendix C.

Because we are particularly interested in how FERS affects separation rates for mid-career personnel, we estimate a model that allows the effect of FERS on separation rates to vary by age. Specifically, the model we estimate is

\[
Pr(Sit = 1) = G(a + b_1F_{it} + b_2(F_{it} \times A_{it}) + cX_{it})
\]

(4.2)

The variables represented by \(A_{it}\) are indicators of the individual’s age group. The estimated effect of FERS on separation rates will equal \(G(a^* + b_1^* + b_2^*A^*_{it}) + cX^*_{it}) - G(a^* + cX^*_{it})\), where \(a^*, b_1^*,\) and \(b_2^*\) are parameter estimates of \(a, b_1,\) and \(b_2,\) respectively. \(A^*_{it}\) represents the mean values of \(A_{it},\) and \(X^*_{it}\) represents the mean values of the variables included in \(X_{it}.\) The estimated effect of FERS on separation rates for individuals in a given age group will be \(G(a^* + b_1^* + b_2^* + cX^*_{ij}) - G(a^* + cX^*_{ij})\), where \(j\) indicates the age group of interest.

We present the results of our empirical analysis in the next chapter.

Figure 4.11—Separation Rates by Age When YOS ≥ 31
(CSRS in FY83 and CSRS in FY96)