The analysis presented in this report relies on three measures of personnel quality—education, supervisor rating, and promotion speed—and focuses on three personnel outcomes—pay, promotion speed, and length of stay. This chapter describes the hypothesized relationships between the quality measures and the outcome measures. The empirical implementation and the data used are described in Chapter Three. This chapter provides a simple, brief overarching framework and a context for the results that are presented later.

The analytical framework can be represented by a series of equations, the first of which specifies the factors that affect personnel quality. It is hypothesized that personnel quality at time $t$, $Q_t$, captures factors that make the individual productive both within the civil service at his or her specific job and outside the civil service. These factors include education and training, innate ability and talent, and motivation. Individual productivity also depends on the individual’s job, the skill requirements of the job, the type of equipment used, and the relationship of the job to the organization’s overall output. More formally, $Q_t$ is given by

$$Q_t = Q(\text{education}, \text{motivation}, \text{ability}, \text{job factors}) \quad (2.1)$$

Few data exist on the factors that determine personnel quality. We use entry education as a quality measure, but as Equation 2.1 makes clear, education is only one of many factors.
Quality affects the way supervisors assess the productivity of civil service personnel. The accuracy of supervisor ratings can be affected by other factors as well, including how frequently the supervisor can monitor the worker’s output, the method used to monitor output, whether individual output can be easily observed or can be observed only at significant cost, and the supervisor’s subjective bias. More formally, the supervisor rating at time $t$, $A_t$, is given by

$$A_t = A(Q_t, \text{monitoring frequency, technology, and cost, subjective assessment})$$ (2.2)

When a vacancy exists in a non-entry-level position, whether it is filled by promoting from within or by hiring externally depends on the supervisor’s assessment of qualified and available personnel in lower-level grades. Therefore, speed of promotion to a higher grade depends on job vacancy rates, the individual’s willingness to accept the responsibilities associated with working at a higher grade, and the supervisor’s assessment, including previous ratings. More formally, speed of promotion, $P$, is given by

$$P = P(A_t, \text{job vacancy, willingness to move up, eligibility for promotion})$$ (2.3)

Promotion speed in Equation 2.3 depends on supervisor rating, $A_t$, which, in turn, depends on personnel quality, $Q_t$. The approach to estimating Equation 2.3 is discussed in Chapter Three. Because supervisor rating captures not only quality but also other factors relating to monitoring and the accuracy of the supervisor’s assessment, both education—a determinant of $Q_t$—and supervisor rating are included as covariates in the analysis of promotion speed. With education included as a covariate, supervisor rating captures the effect on promotion speed of other determinants of $Q_t$ as well as factors that affect the accuracy of the rating.

Whether higher-quality personnel decide to stay in the civil service or leave depends on an array of factors. While developing a model of retention in the civil service is beyond the scope of this analysis, these factors will reflect the individual’s internal and external opportunities and the determinants of these opportunities. The opportunities are captured by such variables as pay, benefits, and promo-
tion speed, the individual’s taste for federal service or nonfederal service, health status, and job flexibility. More formally, retention, $R_t$, is given by

$$ R_t = R(P, \text{pay and benefits inside and outside the civil service, taste for federal service}) $$

(2.4)

As will be discussed in more detail in later chapters, the retention equation is estimated in two ways. The first excludes $P$ (promotion speed) and includes supervisor rating and education, which may affect both the internal and external opportunities of an individual. For example, a better-educated individual may be able to get a faster promotion within the DoD as well as in an external job. If external opportunities are relatively more attractive, the effects of education and supervisor rating on retention will be negative. The second estimation method includes $P$. If promotion speed reflects internal opportunities, including $P$ as a covariate in the regression equation means that education and supervisor rating capture the effects of external opportunities on retention. That is, when promotion speed is included, the effects of these variables on retention are hypothesized to be negative.

The final outcome variable examined in this analysis is earnings at time $t$, represented by $S_t$. Earnings are determined by a pay table and exclude bonuses in this analysis. Earnings obviously depend on grade and seniority, since these factors affect an individual’s placement in the pay table. However, other factors as well affect pay levels and the rate at which pay grows over time. For example, as indicated in Equation 2.3, promotion speed, which affects pay growth, depends on supervisor rating $A_t$, which in turn depends on $Q_t$. Pay also depends on labor market experience, seniority within the civil service, occupation, and various job characteristics. More formally, $S_t$ is given by

$$ S_t = S(A_t, \text{occupation, experience, seniority}) $$

(2.5)

As discussed in more detail in Chapter Three, Equation 2.5 is estimated using both $A_t$ and education as covariates. These factors are both used because supervisor assessment, $A_t$, captures quality factors other than education that affect civil service pay.