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The determinants of the probability of promotion

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The Determinants of the Probability of Promotion

by

Robert Kaestner

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Abstract

The Determinants of the Probability of Promotion

by

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This paper is a detailed empirical analysis of promotions among the professional ranks of a large U.S. manufacturing firm. A model based upon the existence of an internal labor market and multi-period employment contracts is utilized to examine the determinants of the probability of promotion among this group of employees. As an innovation, this research introduces into the model the possibility of unanticipated costs (to the firm) of promotion, and tests whether this phenomena is an important aspect of the promotion process in the firm under study.

There is also an extensive empirical agenda guiding this analysis which concentrates on the following areas:

- 1) Identifying the relative importance of general versus specific training in the promotion process.

- 2) Identifying the separate contributions of performance (productivity) and seniority in determining who is promoted.
- 3) Testing for the possible bias due to sample attrition.
- 4) Testing for differential treatments of various race and gender groups.

The results of this analysis indicate that the primary determinants of promotion, for this group of employees, in this firm are: an employee's position in the job hierarchy, an employee's current performance, the accumulated seniority of the employee and in some instances what functional group the employee is apart of in the firm. Further results show that seniority and specific job training dominate current performance at lower level jobs, in regard to the probability of being promoted, and for higher level positions the reverse is true. There does not appear to be much value placed upon previous work experience or general training when choosing employees for promotion.

Tests for discrimination on the basis of sex or race illustrated that the firm is not a discriminator and the possible bias due to sample attrition was shown not to be present. It was also the case that unanticipated costs of promotion are not manifest and it is concluded that they are not relevant in the firm under study.

In summary this research provides a unique look at a representative firm in today's labor market. A careful and extensive empirical analysis illustrated several important aspects of the promotion process for professional employees.

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INTRODUCTION:

There has been widespread interest among economists in the level and determinants of occupational achievement. This interest has focused primarily on the earnings of individuals at the expense of other possible measures of the achievement process. The preponderance of studies examining earnings is not surprising given the importance of earnings to an individual and the concise summary of the achievement process it affords researchers. The development of the "human capital" model (Mincer 1974, Becker 1962) of earnings also provided a powerful theoretical framework from which to design an empirical analysis. For these reasons, along with the abundance of data on earnings, economists have concentrated their efforts in this area. Other measures of achievement are not without merit however, and the purpose of this paper is to examine one such measure, namely promotions.

The promotion process is an integral part of the allocation of the firm's human resources. Firms make major investments in devising structures that maintain the efficient organization of their internal labor market. Personnel departments are created or expanded, training programs devised and implemented, performance evaluations formalized and information retrieval systems installed. The management of people is widely seen as an effective cost control variable (Miner and Miner 1977). The level of sophistication and

manner of organization might differ among firms, but the recruitment, evaluation and selection of qualified employees to fill positions in the firm hierarchy is clearly an important element of firm behavior (Spence 1976).

To the employee, the promotion process is an important aspect of an individual's experience in the labor market. Indeed it is an important determinant of earnings in the market since it is often the case that earnings are determined by an employee's position in the occupational hierarchy (Wise 1975, Lazear and Rosen 1981, Carmichael 1983, Mirlees, 1976) as well as their personal attributes. The occupational hierarchy of most large firms is a predetermined structure that has clearly observable boundaries regarding earnings, responsibilities and non-pecuniary opportunities. Although earnings and promotions are positively correlated it has been noted that earnings are a less than perfect "index" of the "type" and "level" of a job (Killingsworth and Reimers 1983).

An analysis of earnings will tend to blur the distinctions between employees regarding a host of non-pecuniary benefits (e.g. job autonomy and training opportunities)¹. By neglecting to acknowledge differences among employees due to their position in the firm, an analysis of earnings is an incomplete description of the achievement process (Wise 1975). It is in this light that an analysis

of promotions can bring additional information to the occupational achievement story. By making explicit the importance of organizational structure and by examining the determinants of job changes (i.e. the "type" and "level" of a job) we can gain valuable insights not accessible in earnings analyses.

This paper examines the promotion process of a large U.S. manufacturing firm². Special attention will be paid to the following areas;

1. The importance of the organizational structure of the firm.
2. The relative importance of specific versus general training.
3. The relative importance of performance versus experience.
4. The effects of employee separations from the firm on estimation procedures.
5. The differences in promotion probabilities among race and gender groups.

An important hypothesis underlying this paper's scrutiny of the relationship between the promotion process and the points enumerated above is the existence of internal labor markets (ILM) in large bureaucratic firms (Doeringer and Piore 1971). The ILM is characterized as having few ports of entry, a promotion from within policy, specific training opportunities, seniority based rewards and clearly defined career paths or promotion ladders (Baron, Davis-Blake, Bielby 1986).

This often observed characterization of firms has led to many areas of research that question the simple neo-classical model which asserts that the equality between the value of the marginal product (VMP) and the wage holds universally (Malcomson 1984). Principal among these alternative models of occupational achievement are the "incentive contract" literature (Lazear 1979) and the "human capital" model (Becker 1975, Oi 1962). This paper attempts to model and test a few of the important issues in this debate. Although most of the past work has been concerned with wage determination and wage growth, there are natural and complimentary applications to the promotion process. Thus, the primary focus of the current research is to illustrate the implications that these alternative theories have for the promotion process and to test some of these implications empirically.

The balance of the paper will be divided into the following parts. The next section specifies a theoretically consistent empirical model of the promotion process. Following this some of the problems associated with estimating the model and proposed remedies are outlined. The next section presents a description of the data and definitions of the variables used in the analysis. A section presenting the results of estimating the model will follow. The paper concludes with a summary of the results.

MODELS OF PROMOTIONS:

To date, there has not been an abundance of theoretical or empirical work in the area of promotions. As noted above this situation is probably attributable to those factors that have made earnings the measure of choice among economists interested in occupational achievement. Empirical work on promotions has been especially hampered by a paucity of appropriate data sources.

The theoretical work in this area has largely been concerned with the issue of optimal incentives in labor contracts (Stiglitz 1975, Mirlees 1976, Lazear and Rosen 1981, Nalebuff and Stiglitz 1983, Lazear 1979, 1986). Its relevance to the promotion process can be found in the fact that the incentive offered an employee is often a promotion to a higher paying position. The "incentive contract" theories are based on the observation that an employee's effort (Stiglitz 1975, Lazear 1986) or quality (Stiglitz 1975, Mirless 1976) cannot be costlessly observed and that through an appropriate structuring of the compensation system an employee's effort or quality can be efficiently determined.³ The incentives in the compensation system will provide the employer with "signals" about the uncertain abilities of the employee (Spence 1975); and as long as part of the employee's compensation is based on their own "input"

(time), the employer has an incentive, in the form of reduced costs, to obtain this information. Even when the employee is paid their exact marginal product, but there are costs associated with hiring or promotions (e.g., training, selection), it is in the interest of the employer to devise a scheme to identify the most capable employees (Stiglitz 1975).

Two additional points derived from the "incentive contract" literature that have particular importance to an analysis of promotions are: 1) a hierarchial organization of production is often an efficient mode of production, and, 2) the link between the internal and external labor markets is strong and direct. The first point, regarding firm hierarchy, is interesting because it is in accord with the often observed bureaucratic structure of large firms (e.g., the firm under study) and as an illustration that positions within a firm differ with regard to responsibilities, autonomy and status as well as pay (Stiglitz 1975, Mirlees 1976). The example used in the literature (Stiglitz 1975) is that of a supervisor in a firm with a simple production technology that uses only one type of labor. The employer and employee have an incentive to establish a supervisory level position. The employer needs to monitor inputs, or relative effort, and the employee wants to reduce the risk that their, or their fellow workers lack of, effort will go

unrecognized. Thus a hierarchy based on "authority" is established. The second point is important since it provides support for the generalization of any results derived from this study to the market (e.g., product, industry, etc.) within which this firm operates. It has been shown (Stiglitz 1975, Mirlees 1976) that the incentive structure of a firm is determined by the market wage and alternative employment opportunities. The upshot is that the incentive structure cannot be arbitrary or radically different from other firms with similar production functions.

The empirical work analyzing of promotions can be divided into two groups. In the first group (Wise 1975, Killingsworth and Reimers 1983) the distinctions between "type" and "level" of a job are investigated and compared to an earnings model. In these analyses the question under consideration is whether or not a promotions analysis can add to the understanding of occupational achievement beyond that obtained by an earnings analysis. The conclusion reached in both analyses is that relying solely on earnings to illustrate differences in occupational achievement is limited and a promotion analysis can offset these limitations and complement the earnings model. The second group (Olson and Berger 1983, Medoff and Abraham 1983) is interested in the relative contributions of seniority and performance (productivity) in promotion decisions. The dichotomi-

zation of these two determinants of promotions is motivated by the claims of human capital theory that seniority should play no role in non-union (or non collective bargaining) settings. This is in contrast to what would be expected in a firm characterized by an ILM. Under these circumstances the seniority rights (i.e. a promotion rule) of employees are protected so that an efficient system of training new employees (e.g. senior employees train junior employees) is maintained (Baron, Davis-Blake, Bielby 1986). The human capital hypothesis also clashes with the "incentive contract" literature which postulates a return to seniority which induces less shirking on the job and/or lower turnover. Related to the seniority versus performance debate is a theoretical paper by Carmichael (1983) which provides a rationale for why a return to seniority, net of productivity, might be observed in a non-union (meritocratic) setting. It is closely linked to the "incentive contract" literature since its main result is that a properly structured incentive (i.e. a promotion) can induce the correct amount of investment in firm specific training. The often noted dilemma surrounding investments in specific human capital (where investment returns are uncertain due to turnover) (Becker 1975) can be avoided if the worker pays the full cost of the investment and then is guaranteed a future return (incentive) by a seniority rule that "enforces" the

implied contract between employer and employee (Carmichael 1983). Thus, the Carmichael hypothesis is also consistent with the characteristics displayed by an ILM. The kernel of the Carmichael hypothesis is that the full costs of separation are borne by the party initiating the separation. If a separation occurs because an employee quits or induces the firm to fire them, the employee will lose their investment. On the other hand, if the firm fires an employee or induces them to quit, the firm will not save on its wage bill since a junior employee is immediately promoted by the seniority rule. In this way, seniority has an independent contribution to the overall productivity of the firm and the employee shares in the benefits from this return. Trying to identify the separate effects of seniority and performance has been the central question of the Abraham and Medoff (1985) and Olson and Berger (1983) papers although those authors appear not to have been aware of the Carmichael (1983) paper.

The empirical specifications of all of the above analyses are closely linked to the specification of the earnings function (Mincer 1974). The major difference is that in an analysis of promotions the dependent variable has a discrete number of outcomes and some type of maximum likelihood estimation technique is warranted. The usual array of human capital variables, experience, tenure, education,

and age have been used as well as several somewhat idiosyncratic measures such as quality of education, military experience, industry codes, union status, race and gender.

EMPIRICAL SPECIFICATION

Key to a formulation of a model of promotions is what determines who receives one. In this paper I will make promotions⁴ primarily a function of ability which is revealed to the employer through the performance (productivity) of the employee (Beckmann 1978). The employer has constructed an incentive structure that will insure optimal effort on the job and in this way employees can distinguish themselves according to true abilities (Stiglitz 1975, Lazear 1986). The most able or productive employee will then be chosen for the available position. The type of model I have in mind is a "rank order tournament" (Lazear and Rosen 1981) or "competitive contest" (Nalebuff and Stiglitz 1983) where the incentive structure is based on relative outputs. This particular form of "incentive contract" has been shown to be a flexible and often times efficient (first best) form of compensation (Nalebuff and Stiglitz 1983) especially under the assumption of risk neutral workers. An incentive structure of this type is particularly valuable when the exact value of an employee's contribution is difficult to measure but his/her relative

standing is more readily accessible. Workers compete against each other for promotions to higher "level" (i.e., pay, status, etc.) positions. Complementing the specification's reliance on ability (productivity), several measures of costs of promotion will be included in the model. There are costs to setting up the incentive structure (Stiglitz 1975) and maintaining information on employees as well as the costs of training newly positioned employees. In the literature some of these costs have been attributed to "luck" (Wise 1975) or random components (Beckmann 1978, Lazear and Rosen 1981, Lazear 1986). For example, what Wise (1975) refers to as "luck" are really some unobserved factors that explain differences in promotion rates among employees. Some components of "luck" in the Wise (1975) formulation are geographic and/or functional location in the firm. In the current paper these types of factors are considered costs due to the segmentation of the ILM and functional specific skills. In the following analysis the costs of promotion will be made explicit.

Following closely Olson and Berger (1983) an empirical model of promotions will start with a competitive firm maximizing profits, which yields the well known introductory text result:

- 1) $VMP = WAGE$ (Price of the factor)

In this case however, the firm does not know with certainty what the VMP is since the prospective candidate for promotion has had no experience in the particular position to be filled (transfers are not promotions) and exact output is difficult to measure. Therefore, we can amend #1 to be the following;

$$1a) E[VMP] = E[\text{Price of the factor}]$$

where E is the expectations operator. The right hand side can be made more explicit by using the following identity:

$$1b) E[\text{Price of factor}] = W + E [C]$$

where:

W = wage

C = marginal costs of promotion borne by the firm

The wage [W] is the pre-determined rate set by the company in accord with the incentive structure it has chosen, presumably to maximize output (e.g. worker effort). The workers have knowledge of this compensation scheme before they come to the firm. This assumption makes the payoff structure of the tournament independent of the workers choices (Lazear 1986). The costs [C] of promotion

can be selection and recruitment costs and/or the training costs associated with learning the new position. ⁵

Thus, #1 now becomes:

$$2) E [VMP] = W + E [C]$$

To simplify matters for now, we will assume that $E[C] = C$, that is the firm knows with certainty the full costs of promotion. Since W is pre-determined by the firm (Lazear and Rosen) ⁶ a minimum skill level and applicant pool has been established. The firm will not promote an individual incapable of performing at a level equal to $W+C$ and an employee, whether inside or outside the firm, will not apply for the position if they are worth more than W on the market. The combination of this minimum skill level and the applicant pool will determine the pool of promotable individuals. The group of promotable individuals can include employees from outside the firm. The expected probability of promotion for employees in the firm is equal to the number of available positions divided by the number in the pool of promotables, multiplied by the proportion of firm employees in the promotable pool. This ignores the fact that employees in the firm will probably have a special advantage due to firm specific training (Olson and Berger 1983) and better information regarding openings. Furthermore, the firm would have to be able to rank the

non-employees and this would probably lead to these employees facing a further disadvantage since the current firm would have no reliable (i.e., their own) information regarding their performance. It is thus reasonable to conclude that under an incentive system structured as a competitive contest all new employees to the firm would start at entry level positions (Malcomsen 1984). This is consistent with the existence of an ILM. The equality sign of equation #2 should be interpreted as a lifetime (with the firm) present value condition since it has been established that under the assumptions of a "rank order tournament" the equality would hold only by pure chance at any one point in time (Lazear and Rosen 1981).

The firm does not know $E[VMP]$ but it does know the relative abilities of the employees. The employees have demonstrated their abilities (effort) in response to the incentive structure and thus the firm is able to rank them accordingly. The firm knows with certainty the ranking. The researcher, however, never observes the firm's ranking but only whether an employee is promoted. We can define an index P as follows:

$$P = 1 \text{ if } VMP_i \geq VMP_j \quad \forall i \neq j$$

$$\text{and } E[VMP_i] \geq W+C$$

= 0 otherwise

If we assume that the VMP is constant so that $VMP = E[VMP]$ we can rewrite the above as:

$$P = 1 \text{ if } E[VMP_i] \geq K \\ = 0 \text{ otherwise}$$

where K is the maximum between the minimum skill level ($W+C$) and the greatest relative $E[VMP]$ among the pool of promotables. The firm knows K with certainty but the researcher does not observe this value or the exact value of the firm's ranking. We can estimate the probability that an individual is promoted as follows (Maddala 1983, Amemiya 1981);

$$\begin{aligned} 3) \text{ Prob } (P=1) &= \text{Prob } [E[VMP] \geq K] \\ &= \text{Prob } [XB+N \geq K] \\ &= \text{Prob } [N \geq K - XB] \\ &= 1-F [K - XB] \end{aligned}$$

where:

X = a vector of variables determining $E[VMP]$

B = unknown parameter vector

N = a random component which represents the unmeasured firm assessment of an employees ranking assumed to be $N(0, \sigma^2)$

F = cumulative normal distribution function.

Equation #3 can be estimated by maximum likelihood techniques which yield consistent and asymptotically efficient estimates of the parameter vector B ⁷.

Before continuing however, it is appropriate to further explore the issue of costs of promotion and how they affect the promotion decision. The firm will promote an individual with the highest ranking (according to relative outputs) subject to the following constraint;

$$4) \int_0^T E[VMP]e^{-ru} du \geq \int_0^T we^{-ru} du + C$$

or

$$C = \int_0^T E[VMP]e^{-ru} du - \int_0^T we^{-ru} du$$

where everything is defined as before and;

r = discount rate

T = expected tenure for the job

W = the wage specified for the new position consistent with a lifetime wage that equals lifetime $E[VMP]$.

Equation #4 is simply the requirement that the applicant be minimally qualified expressed in present value terms. This new representation of this constraint reflects the multi-period nature of the problem. Equation #4 illustrates the firms desire to recoup its investment costs over the expected job tenure of the employee.⁸ In order to satisfy the zero profit condition the firm would have to choose among varying costs of promotions associated with different employees. This assumes that the costs are not known with

certainty or else they would be incorporated into the incentive structure (e.g. through lower wage). Equation #4 also illustrates the importance of expected tenure in the promotion decision. Even if the employer could rank employee's productivity and measure the costs of promotion with certainty, the zero profit condition would also necessitate knowing the expected length of tenure. In a simple world of a zero discount rate, constant VMP and wage, expected tenure would equal the costs of promotion divided by the difference between the VMP and wage in one period.

The importance of expected tenure to the promotion decision illustrates an often cited problem with the incentive contract theory, the absence of a mechanism that enforces the implied contract between employer and employee. In this case the employee could quit and the firm would lose its investment costs. On the other hand, the firm could terminate the employee and the employee would lose the expected return on which their investments (in effort) were based. The response to this dilemma for the employee would be to develop and maintain information regarding firm cheating (Malcomson 1984). Firms that cheat, that is terminate workers, would thus be unable to attract quality workers and would then be at a disadvantage in the market. For the firm, the presence of costs of promotion, which are necessarily paid by the firm, and a fixed wage independent of

those unknown costs (at time of implementation), the problem is still unresolved. The worker could leave the firm shortly after being promoted and thus the firm's costs would never be recouped. A pension plan could be devised to diminish the probability of this occurring since some compensation would be forfeited by the worker. This is just one possible solution but one which also illustrates the differences in jobs (job levels) not captured by an examination of wages.

It has been suggested above that the promotion decision is a two part decision. The first part is to rank employees and choose that individual with the highest rank to be promoted. The second part is to insure that the employee promoted will be a good investment. These two decisions do not appear to have a parsimonious empirical specification so an ad hoc procedure is warranted. Supporting the decision to use an ad hoc procedure is the fact that in the current research only one firm is being analyzed so employees outside the firm will be ignored. This prohibits the identification of the appropriate pool of promotable employees on which a true promotion analysis must be implemented. It is also very difficult to identify the pool of promotable individuals within a firm for a particular position. For these reasons an ad hoc specification of the promotion process will be utilized which views promotions as an outcome and explains this outcome by some observable inputs.

The specification chosen will be similar to equation #3,
or:

$$3a) \text{ Prob } (P=1) = n 1-F(-XB)$$

where everything is defined as before except the X vector now includes the expected tenure of the employee and factors that measure the costs of being promoted. Equation #3a is useful because it retains the probabilistic nature of the problem although it was not derived from a theoretical model.

The problem now is to examine the promotion process including the effects of expected tenure and the costs of promotion. Expected tenure however is an unobserved measure so we need to find a suitable proxy. One proxy candidate might be the individuals current probability of leaving the firm. These two measures should be closely related especially if unobserved determinants of separation propensities are stable over time. An employee will leave the firm if his/her expected utility (here measured by income) gain associated with staying with the firm falls below some market alternative including leisure and the costs of leaving (Burdett 1978, Mortensen 1978, 1978, Weiss 1984).

Thus, we could use the following representation:

$$5) E[U] = W_0 + \int W_u e^{-ru} du + CL$$

where:

U = utility (income)

W_o = current wages

W_u = future wages

CL = costs of leaving

r = Discount rate

The problem here however, is that the future discounted earnings of an employee cannot be observed, but it should depend on two factors (Weiss 1984, Solnick 1986); 1) an individual's personal attributes and, 2) the firms organizational structure and future demand. So the right hand side of #5 will depend upon current personal attributes of the prospective candidate and firm characteristics, or;

$$5a) \quad E[U] = X_o B_o + X_w B_w + X_c B_c + V$$

where:

X_o = a vector of personal characteristics that determine current wages

X_w = a vector of personal characteristics that determine future wages

X_c = a vector of attributes determining costs of leaving

B_o, B_w, B_c = unknown parameter vectors

V = random disturbance $N(0, \sigma^2)$

Included in the vector X_w will be those factors that determine employees probability of being promoted since

this represents a wage increase. The wage increase is a premium above the earnings that an employee's productivity would warrant. The employee receives a wage according to a pre-determined incentive structure that does not mandate an equality between the VMP and the wage [Lazear and Rosen]. The premium is the probability of winning the contest and represents the incentive to perform better.

The employee will leave the firm if the expected utility of staying falls below some market alternative, but the expected utility is never observed. Only an index Q defined as follows:

$$\begin{aligned} 6) \quad Q &= 1 \text{ if } E[U] \leq K_q \\ &= 0 \text{ if } E[U] > K_q \end{aligned}$$

where K_q is equal to the value of the market alternative.

To derive the conditional probability that an employee will leave the firm we combine equations #5a and #6 which yields (Maddala 1983, Amemiya 1981)⁹;

$$\begin{aligned} 7) \quad \text{Prob}(Q=1) &= \text{Prob} [X_o B_o + X_w B_w + X_c B_c + V \leq K_q] \\ &= \text{Prob} [V \leq K_q - X_o B_o - X_w B_w - X_c B_c] = 1 - F[-ZB] \end{aligned}$$

where F is again the standard normal cumulative distribution function and Z includes X_o , X_w and X_c .

We are now ready to examine the promotion model again including controls for expected tenure and varying costs of promotion. Using equation #7, the probability of leaving the firm, as a proxy for expected tenure and substituting into the X vector of equation #3a will yield the following representation;

$$\begin{aligned}
 8) \text{ Prob (P=1)} &= \text{Prob}[XB + \text{Prob [Q=1]} B_t + N \geq K] \\
 &= \text{Prob}[N \geq -XB - \text{Prob[Q=1]}B_x] \\
 &= 1-F[-XB - \text{Prob[Q=1]}B_t]
 \end{aligned}$$

where we have separated out the effects on the promotion probability of expected tenure and included K in the vector X.

But since the Prob(Q=1) (leaving firm) is dependent upon Prob(P=1) (promotion) as shown by equation #7, the two equations #7 and #8 form a simultaneous system and will need to be estimated together (Heckman 1978, Nelson and Olson 1978, Maddala 1983, Ashford and Sowden 1970). Estimates of both equations #3a and #8 (with 7) will be derived to test whether or not the introduction of unanticipated costs of promotion as formulated above is an appropriate representation of the promotion process. If there is no new information gained from the more complex formulation embodied in equation #8 then it can be concluded that the hypothesis was invalid.

The general problem is to attempt to quantify those factors that influence a firm's decision to promote an employee. We know that firms take great pains to manage their work forces but we never observe how the process is accomplished. Usually there are some formal aspects (e.g. performance appraisals, seniority rules) to the promotion decision but more often than not the decision also involves a complex set of unobserved criteria. It is the intention of this paper to explore empirically the relationship between the outcomes of the promotion process and several inputs to the decision suggested by theoretical considerations.

ECONOMETRIC PROBLEMS:

Beginning with equation #3a the first problem that arises, (originally noted by Wise (1975)), is that since estimating promotion probabilities necessitates an inter-temporal (e.g. year to year) analysis there is a possibility of attrition bias. That is, if you are looking at the probability of being promoted within a year (as is the case presently) there are almost certainly going to be some employees who leave the firm in that interval. If the unobserved factors that determine whether an employee leaves the firm also influence the probability of being promoted, the estimates of the promotions model will be seriously biased

(Heckman 1976, 1979). In the present research there is a substantial likelihood that this could be the case. For example, employees with a high probability of being promoted are also likely to have many alternative (outside the firm) opportunities and thus more likely to leave. This would truncate the sample from above. Another example, are those employees with a very low probability of being promoted who are also more likely to be fired (encouraged to leave). This would truncate the sample from below. Estimating the promotion probabilities with either (or both) of the samples outlined above will bias the estimates.

In response to this problem, two different techniques will be implemented. First, is a procedure similar to that developed by Heckman (1976, 1979) which is based on a two step process of estimating the probability of staying with the firm by maximum likelihood techniques, and then constructing the inverse mills ratio and estimating an OLS regression of the probability of promotion including the inverse mills ratio as a regressor. This technique has been shown to be efficient in an OLS regression but since we are confronted here with a binary dependent variable, the second step will still lead to inconsistent estimates (Van de Ven and Van Praag 1981). Following Van de Ven and Van Praag (1981) the Heckman procedure can be modified for a probit specification, but the standard errors of this modified

procedure will still be inefficient¹⁰. In order to fully control for the attrition bias a full maximum likelihood procedure needs to be estimated where the bivariate distribution of the two measures (promotions and separations) is explicit¹¹.

The next problem that needs to be addressed regarding equation #3a is the possible bias introduced into the estimates when tenure (and experience) is included in the promotions equation. If there are unobserved factors, such as worker or job match quality, that determine both tenure and the probability of being promoted, then the estimates of tenure (and other coefficients) will be biased (Mincer and Jovanavic 1981, Altonji and Shakotko 1984, Abraham and Farber 1987). This "unobserved heterogeneity" among employees leads to the usual problems associated with omitted variables (Johnston 1984). To date there have been two solutions suggested in the literature to overcome this problem. The first method makes use of an employee's previous work history (Mincer and Jovanavic 1981, Altonji and Shakotko 1984) by including an additional regressor (number of previous employers) to control for person specific (- Mincer and Jovanavic 1981) unobservable components, or by using an instrumental variable (for tenure) technique (Altonji and Shakotko 1984) to purge the correlation between tenure and the error term due to unobserved person/job/job

match components. This method is not available in the present case since a detailed history of an employee's previous work experience is not available. The second method proposed includes a measure of the expected job tenure in the model (Abraham and Farber 1987). By including a measure of expected tenure in the model, the bias of the estimates due to omitted variables (unobserved heterogeneity), will be reduced as long as expected tenure is correlated with the person/job/job match components which have been left out of the model. The assumption embodied in this correction is that expected tenure is in fact a good proxy of the omitted variables. Although this approach will not be used explicitly, the following analysis does incorporate this correction in spirit. As assumed earlier in this paper, expected tenure should be correlated with an individual's propensity to separate (quit or layoff) from the firm. So by making use of the propensity to separate, that is the selectivity correction, the bias in the tenure (and other) coefficients should be driven toward zero (Abraham and Farber 1987). This assumes that there is a correlation between the propensity to separate and the unobserved heterogeneity of the sample.¹² Also the inclusion of variables that are job (functional group, occupational group) and/or person (degree while working, occupational group) specific should help reduce the bias often observed in studies that use less detailed data sources.

It should also be mentioned that by including the employee's time in salary grade (as is the case presently) in the model of promotions a similar bias as that described for tenure could arise. The solution to this problem, however, is not as evident as was the case regarding tenure. The basic problem is to find an instrumental variable to replace time in salary grade. This question will be left for future research.

With regard to the system of equations, #7 and #8, the attrition bias problem is still present, but the bias due to tenure (unobserved heterogeneity) has been partially corrected by the explicit inclusion of the separation probability. In this model the separation probability is entered as the reduced form estimate of equation #7, whereas in equation #3a the separation probability is entered as the inverse mills ratio (hazard rate). It is important to note that in regard to equation #3a the correction for attrition bias should be viewed as a simple indicator variable where inclusion in or exclusion from the sample is determined. The correction of equation #7 has been developed with more of a sense of structure and as a part of a larger model. A key issue addressed by comparing these two sets of results is the sensitivity of the correction to the specification of the selection equation.

The inverse mills ratio is a monotonic decreasing function of the separation probability (Heckman 1979) so we would expect a reversal of sign between the two measures if estimated. It should also be noted that the system of equations can be estimated over the entire sample, including individuals who left the firm during 1982.

Estimating over the entire sample allows for the identification of the structural parameters but creates difficulties when correcting for attrition bias. Attrition bias is still a problem due to the fact that a partially censored spell is as detrimental to the specification as a totally censored spell, where censored refers to time at risk for promotion ¹³. Given the simultaneous nature of equations #7 and #8, it is not possible to correct for the attrition bias and identify the structural parameters. It is thus preferable to use a reduced form model of promotions which can be rewritten in general as follows;

$$7a) \quad Q = b_0 + b_1 Z + b_2 P + V$$

$$8a) \quad P = a_0 + a_1 X + a_2 Q + e$$

and the reduced forms;

$$7b) \quad Q = C_0 + C_1 X + C_2 Z + e$$

$$8b) \quad P = d_0 + d_1 X + d_2 Z + e$$

After correcting for the attrition bias in 8b we derive;

$$8c) \quad P = d_0 + d_1X + d_2Z + d_3 \lambda + e$$

where λ is the inverse mills ratio calculated from equation #7b. We can apply the same procedures as those outlined for the single equation model, to correct for the attrition bias. The models of equation #3 and #8b differ in that equation #8b includes an additional set of regressors that fall out of the reduced form solution. These additional regressors represent the effects of variables unique to the separation equation on promotions. The reduced form model can be estimated on the sample of employees who stayed in the firm throughout 1982 or on the entire sample, including both stayers and leavers. For comparative purposes however it would be preferable to leave the samples the same, that is use those employees with only completed spells of tenure.

Estimation of the various models described above should provide a variety of empirical results from which to make comparisons. From the results of an uncorrected (for attrition bias) estimate of equation #3a to the estimates of the system of equations #7 and #8, we should be able to parse out and verify the affects of the above hypotheses regarding the promotion process. The incremental empirical strategy that will be implemented is parallel to the logic that led to the model specification. It will be convenient

and instructive to comment on the validity of the various specifications utilizing this type of methodology.

DATA AND VARIABLES

The data used in this analysis were drawn from the personnel file of a large U.S. manufacturing firm. The file was assembled for a sample of management (salaried) employees with at least a Bachelors degree at time of hire. It was further restricted to those employees who were active in the company on December 31, 1981 and who were hired before January 1, 1981. The result was a total sample of 15,835 employees. All analyses were done separately for white men (15,103), white women (1,151), and black men (463). In addition, some combined analyses were performed.

The functional form of the models was given in the previous section and a definition of the variables used in the promotions equations is as follows:

EXP = Total labor force experience measured as the time from the receipt of the highest degree prior to time of hire until 12/31/81. This measure was corrected for intervening gaps between degrees.¹⁴

EXPSQ = The square of EXP.

TENURE = The time from date of hire until 12/31/81.

TENSQ = The square of TENURE.

SERVGD = The time the employee has spent in their current salary grade until 12/31/81.

SERVGDSQ = The square of SERVGD.

M.A. = Dummy variables indicating possession of a
PH.D. Masters or Ph.D degree. Bachelor degree is
reference group.

WDEG = Dummy variable equal to 1 indicating receipt of a
degree while employed with the firm.

PRATE = A variable indicating whether the
employee received a performance evaluation
rating of 1 - 5 with 5 being the highest.

ENG = a set of dummy variables
SCI indicating the major field of
COM study; ENG (engineering), SCI (physical
LAW sciences), COM (computer), LAW (law),
BUS BUS (business). The reference group
was all other fields.

MKT = Dummy variables indicating what functional
RES group the employee was in as of 12/31/81.
MAN The functional groups are marketing (MKT),
APC research (RES), manufacturing (MAN),
PER administration/control (APC) and personnel (PER)
Operations is the reference group.

GRAD46 = Dummy variables indicating the salary
GRAD79 grade level of an employee as of 12/31/81.
GRAD1012 The reference group is grades 1 - 3.

PROM = A dummy variable indicating a promotion to a
higher salary grade in 1982.

Variables used in the separation (stayer) equation
are the same as above except for the major field of study
dummies which were omitted and the following:

SAL81 = the monthly salary of the employee on 1/1/81.

NCHIL18 = the number of employee's children aged eight-
teen or less.

MAR = a dummy variable indicating whether the employee
was married as of 1/1/83.

STAYER = Dummy variable equal to 1 if an employee was
with the firm as of 12/31/82.

The specification of the experience terms (EXP, TENURE, SERVD) in this overlapping fashion is done to allow for the identification of separate general and specific training effects. In regard to the promotions equation the following representation can be used:¹⁶

$$i) P = b_1G + b_2G^2 + b_3S + b_4S^2$$

where:

G = general training

S = specific training

b_i = unknown parameters

General training and specific training are equal to the following identities:

$$ii) G = a_1X + a_2T$$

$$iii) S = a_3T$$

a_i = unknown parameters

where X is total labor market experience, excluding tenure, and T is tenure. Substituting ii and iii into i yields (used presently);

$$iv) P = b_1 [a_1X + a_2T] + b_2 [a_1X + a_2T]^2 + b_3 [a_3T] + b_4 [a_3T]^2$$

In this analysis it is assumed that $a_1 = a_2$. Thus an expression for $\frac{\partial P}{\partial G}$, or the return to general training as

well as $\frac{\partial P}{\partial S}$, or the return to specific training can be derived. This assumption can be thought of in the sense that an individual is devoting as much time investing in general training on this job as they did on previous jobs.¹⁷ It is important to note that the $\frac{\partial P}{\partial T} = d_1 + 2 d_2[X+T] + d_3 + 2d_4T$ where d_1 , d_2 , d_3 and d_4 are reduced form coefficients. This specification is preferred to one where the experience terms are mutually exclusive (additive) components, since in that case the coefficients measure a mixture of general and specific training whereas in the present analysis these effects are separately identified.

The inclusion in the model of functional group dummies addresses two points relating to the costs of promotion. The first is that functional specific skills are not perfectly transferable across groups so the expected training costs of learning a new position will be different among otherwise like individuals. The second point is that there are information costs. Employees need to know about promotion opportunities and managers need to be able to identify potential candidates. If the organizational hierarchy is along functional group lines then there is a strong possibility that there will be different information costs associated with the various functional groups. If mean promotion rates differ by functional group, than promotions within group would be more common due to the added information

costs. In summary, the functional group dummies are included to capture the direct costs of promotion and/or the effects of organization structure.

Along the same line of reasoning as behind the inclusion of functional groups in the model, a set of dummies indicating the type (by field of study) of degree was included. These are hypothesized to capture differences in occupational groups that might affect the promotion process. There are specific human capital investments associated with occupations that might raise or lower the costs of promotion and there are also institutional constraints that might be reflected in these occupational groups. One example of an institutional constraint is the visibility of different positions. It often occurs that the position an employee occupies determines the level of exposure to upper management and this furnishes these managers with better information regarding that employee's abilities. Since occupation is a major determinant of type of position, these informational factors will be controlled for by including occupational categories.

The availability of a performance evaluation rating facilitates the testing of the relative importance of seniority vs. productivity (Medoff and Abraham 1985). Although performance ratings are not perfect measures of productivity, including ratings in the regression should

reduce the coefficient on tenure (seniority) if tenure is a proxy for productivity or "on-the-job" training. If the above effect does not occur, then there is evidence that there are substantial returns to tenure net of productivity¹⁸.

The separation equation includes the usual set of human capital variables, experience and education, which measure a mixture of the employees outside opportunities (general training) and attachment to the firm (specific training or job match fit). Also included are functional groups which measure differences in job satisfaction and job complexity which should influence an employee's decision to stay with the firm (Weiss 1984). A group of variables that measure the costs of an employee who leaves the firm, namely number of children aged 18 or less and marital status are included. The employees wage in 1981 is also included in an effort to control for the current periods wage as opposed to future wages with the firm which the human capital variables should measure. Finally, the degree of study dummies were omitted in order to identify the equation. This restriction becomes trivial in a reduced form model.

To summarize, the empirical analysis will proceed along the following lines. First, a simple promotions model will be estimated. This model will then be reestimated but with a correction for attrition bias. Next an application

of the test, used by Medoff and Abraham (1983), to identify the relative importance of seniority vs. productivity will be implemented. Then the reduced form of the structural model of promotions will be estimated. The empirical section will end with the re-estimation of the reduced form model corrected for attrition bias. All results will be presented for the three race and gender groups as well as for a select number of combined analyses which include different race and/or gender groups. The choice of estimating the unrestricted models (by race and gender) was made because of the probable differences in the labor market experiences of these groups. The effects of discrimination and affirmative action policies are salient issues that the current research is able to address.

The interaction between separation and promotion might be very different for men and women. Women might choose to leave the labor force for home work (child raising) much more often than men. Women and men might also face different market opportunities. If there is sex discrimination in the market, women will tend to separate less from their jobs than men. On the other hand if discrimination is stronger in this firm than other firms, women will tend to separate more frequently and/or be promoted less than men. These are two obvious reasons, of which there could be many, to divide the samples on the basis of gender.

Differences between blacks and whites might arise due to discrimination for the same reasons as those outlined for women. Also, blacks might be subjected to the effects, both internal and external, of an increased concern with affirmative action. This might also hold true for women. These groups could be bid away by other firms thereby exhibiting higher separation propensities, or the current firm could give them special treatment thereby making them less likely to leave the firm.

DESCRIPTIVE STATISTICS

An examination of some simple statistics will be instructive in order to illustrate some of the differences between the demographic groups and to gain a general familiarity with the data.

Looking at table 1, which includes all employees (i.e. leavers and stayers), the first point to notice is that this sample of employees is made up mostly of male employees (93%). This reflects the fact that it is a technically oriented firm that relies heavily on engineers and physical scientists. These are occupations traditionally dominated by males.¹⁹ Approximately 75% of the males (76% white, 59% black) have a degree in either engineering or the physical sciences (e.g., chemistry, physics) while for women this figure is only 56%. This trend is even more pronounced

for the engineering category alone where about 46% of the males and 19% of the women are represented. The sample is also largely white which might also reflect the importance of occupational choice and/or such factors as firm location.

Table 1 also illustrates the fact that white males have about twice as much labor market experience as either black males or females. This ratio holds approximately for all three experience measures. These significant differences imply that the black male and female employees are a much younger group of employees compared to white males. This is another reason supporting separate analyses for the demographic groups identified. These differences in experience (age) might be attributable to changing human capital investments on the part of these minority groups and/or the results of increased affirmative action policies by the firm. The shorter durations associated with time in salary grade exhibited by black males and females also implies that these groups are being promoted more rapidly than white males. The average time spent in salary grade is 4.6 years for white males, 2.0 years for black males and 2.8 years for females. These differences are statistically significant.

TABLE 1A
SIMPLE STATISTICS FOR WHITE MALE EMPLOYEES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	15103	0.11779117	0.32237135	0.00000000	1.00000000
EXP	15103	20.12098656	10.91069742	1.74600000	44.74800000
EXPSQ	15103	523.88953626	458.85593763	3.04851600	2002.38350400
TENURE	15103	17.37051943	10.61437562	0.99700000	44.45200000
TENSQ	15103	414.39245071	397.39244288	0.99300000	1975.95800000
SERVGD	15103	4.59169377	4.73296755	0.01100000	27.50000000
SERVGDSQ	15103	51.65328014	97.14716512	0.00200000	756.34000000
BA	15103	0.62034033	0.48531825	0.00000000	1.00000000
MA	15103	0.19876846	0.39908659	0.00000000	1.00000000
PHD	15103	0.18089121	0.38494077	0.00000000	1.00000000
WDEG	15103	0.14632854	0.35344699	0.00000000	1.00000000
PRATE	15103	3.58299676	0.87072312	1.00000000	5.00000000
MKT	15103	0.17791167	0.38245104	0.00000000	1.00000000
RES	15103	0.15361187	0.36058823	0.00000000	1.00000000
OPT	15103	0.23240416	0.42237931	0.00000000	1.00000000
MAN	15103	0.26239820	0.43995250	0.00000000	1.00000000
PER	15103	0.03462888	0.18284402	0.00000000	1.00000000
APC	15103	0.06991988	0.25502039	0.00000000	1.00000000
MISS	15103	0.06912534	0.25367556	0.00000000	1.00000000
GRAD:3	15103	0.10229756	0.30304925	0.00000000	1.00000000
GRAD46	15103	0.31477190	0.46444034	0.00000000	1.00000000
GRAD79	15103	0.48228829	0.49970274	0.00000000	1.00000000
GRAD1012	15103	0.10064226	0.30086440	0.00000000	1.00000000
SAL81	15103	3202.28504271	858.42316774	975.00000000	7025.00000000
NCHIL18	15103	1.00297954	1.14029929	0.00000000	5.00000000
MAR	15103	0.88611534	0.31768164	0.00000000	1.00000000
ENG	15103	0.46964179	0.49909405	0.00000000	1.00000000
SCI	15103	0.29384890	0.45553865	0.00000000	1.00000000
COM	15103	0.00801165	0.08915152	0.00000000	1.00000000
LAW	15103	0.00860756	0.09237985	0.00000000	1.00000000
BUS	15103	0.17188638	0.37729415	0.00000000	1.00000000
OTH	15103	0.04800371	0.21378114	0.00000000	1.00000000

TABLE 1B
SIMPLE STATISTICS FOR BLACK MALE EMPLOYEES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	463	0.11231102	0.31609025	0.00000000	1.00000000
EXP	463	11.17892657	6.89488152	1.74600000	43.74800000
EXPSQ	463	172.40511344	218.37513350	3.04851600	1913.88750400
TENURE	463	7.55548812	5.17451975	0.99900000	28.52300000
TENSQ	463	83.80338445	107.58983358	0.99900000	813.55800000
SERVGD	463	2.80847084	2.54002145	0.08200000	13.63000000
SERVGDSQ	463	14.32498488	24.66984166	0.00700000	185.75000000
BA	463	0.66090713	0.47391347	0.00000000	1.00000000
MA	463	0.25053996	0.43379271	0.00000000	1.00000000
PHD	463	0.08855292	0.28440464	0.00000000	1.00000000
WDEG	463	0.14038877	0.34776569	0.00000000	1.00000000
PRATE	463	3.12742981	0.82373035	1.00000000	5.00000000
MKT	463	0.20086393	0.40107986	0.00000000	1.00000000
RES	463	0.07559395	0.26463326	0.00000000	1.00000000
OPT	463	0.23974082	0.42738703	0.00000000	1.00000000
MAN	463	0.31533477	0.46515166	0.00000000	1.00000000
PER	463	0.08423326	0.27803774	0.00000000	1.00000000
APC	463	0.07559395	0.26463326	0.00000000	1.00000000
MISS	463	0.00863931	0.09264561	0.00000000	1.00000000
GRAD13	463	0.34557235	0.47606891	0.00000000	1.00000000
GRAD46	463	0.47084233	0.49968902	0.00000000	1.00000000
GRAD79	463	0.15766739	0.36482303	0.00000000	1.00000000
GRAD1012	463	0.02591793	0.15906236	0.00000000	1.00000000
SAL81	463	2433.87688985	575.99718911	1450.00000000	5425.00000000
NCHIL18	463	1.14038877	1.10084062	0.00000000	5.00000000
MAR	463	0.80777538	0.39447485	0.00000000	1.00000000
ENG	463	0.28941685	0.45398224	0.00000000	1.00000000
SCI	463	0.30237581	0.45978394	0.00000000	1.00000000
COM	463	0.02807775	0.16537370	0.00000000	1.00000000
LAW	463	0.01511879	0.12215745	0.00000000	1.00000000
BUS	463	0.22678186	0.41920329	0.00000000	1.00000000
OTH	463	0.13822894	0.34551344	0.00000000	1.00000000

TABLE 1C
SIMPLE STATISTICS FOR WHITE FEMALE EMPLOYEES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	1151	0.23718506	0.42554158	0.00000000	1.00000000
EXP	1151	10.24708601	9.46379087	1.74600000	44.97600000
EXPSQ	1151	194.48829590	359.30879776	3.04851600	2022.84057600
TENURE	1151	7.25564900	8.39738970	0.99900000	44.33100000
TENSQ	1151	123.09944570	290.43480729	0.99900000	1965.26200000
SERVGD	1151	2.00829974	2.44265026	0.01200000	22.84000000
SERVGDSQ	1151	9.88088010	33.57264674	0.00200000	521.50000000
BA	1151	0.69939183	0.45872183	0.00000000	1.00000000
MA	1151	0.21633362	0.41192330	0.00000000	1.00000000
PHD	1151	0.08427454	0.27791987	0.00000000	1.00000000
WDEG	1151	0.09209383	0.28928405	0.00000000	1.00000000
PRATE	1151	3.62728063	0.83045477	2.00000000	5.00000000
MKT	1151	0.22154648	0.41546794	0.00000000	1.00000000
RES	1151	0.14596003	0.35321962	0.00000000	1.00000000
OPT	1151	0.26238054	0.44011963	0.00000000	1.00000000
MAN	1151	0.19635100	0.39740974	0.00000000	1.00000000
PER	1151	0.05386620	0.22585162	0.00000000	1.00000000
APC	1151	0.11381407	0.31772336	0.00000000	1.00000000
MISS	1151	0.00608167	0.07778135	0.00000000	1.00000000
GRAD13	1151	0.47871416	0.49976385	0.00000000	1.00000000
GRAD46	1151	0.40486533	0.49107934	0.00000000	1.00000000
GRAD79	1151	0.10425717	0.30572670	0.00000000	1.00000000
GRAD1012	1151	0.01216334	0.10966238	0.00000000	1.00000000
SAL81	1151	2198.80278019	531.33066281	750.00000000	5875.00000000
NCHIL18	1151	0.22328410	0.61968855	0.00000000	5.00000000
MAR	1151	0.51520417	0.49998602	0.00000000	1.00000000
ENG	1151	0.19287576	0.39472784	0.00000000	1.00000000
SCI	1151	0.37271937	0.48373851	0.00000000	1.00000000
COM	1151	0.07558645	0.26445017	0.00000000	1.00000000
LAW	1151	0.01129453	0.10571977	0.00000000	1.00000000
BUS	1151	0.17723719	0.38203530	0.00000000	1.00000000
OTH	1151	0.17028671	0.37604788	0.00000000	1.00000000

With regard to experience outside the firm the average durations are relatively small with white males having 2.8 years, black males 3.6 years and females 3.0 years. This finding combined with the relatively long tenures of the sample indicates that the firm has a promotion from within policy.²⁰

Looking at the education variables of Table 1, there are small significant differences on the levels of education among the race and gender groups. In general, however, it should be noted that the majority of all employees hold bachelors degrees. White males hold more doctorates than either black males or females, 18%, 9% and 8% respectively. White males have also received an additional degree while employed with the firm in greater proportions than females with the difference being significant. It was previously illustrated that a high proportion of white males received an engineering degree relative to black males and females. Associated with this phenomena is the observation that significantly smaller proportion of white males are represented in the "other" educational category relative to black males and females.

There are several significant differences in functional group representation among the three groups as illustrated by table 1. With regard to all employees however, a majority are in the manufacturing group (except for females)

followed by operations and research (except for black males). In manufacturing, black males are found in significantly higher proportions than white males, and females are significantly underrepresented. Female employees are more likely to be in the marketing function than white males and black males are significantly less likely to be found in the research group relative to white males. There are other differences identifiable in table 1 but in general we can say that there are noticeable occupational differences among the groups.

Finally, with regard to table 1 we can examine the variables associated with the separations model. Males have significantly higher propensities to marry (88% white, 80% black) than do females (52%) and the males also have more children under the age of 18 than females; 1 and .2 respectively. This finding is consistent with intuition and previous labor market studies which have demonstrated that single women and those without children are much more likely to be working than women without these characteristics. As far as salary goes, white males have a significantly higher salary in 1981 than either black males or females.

Table 2 contains the same information as table 1 except it excludes employees who have left the firm during 1982. All of the results obtained in table 1 also hold for table 2. In addition to those results we can examine mean

TABLE 2A
SIMPLE STATISTICS FOR WHITE MALE EMPLOYEES
EXCLUDING SEPERATIONS

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	13935	0.12587011	0.33171482	0.00000000	1.00000000
EXP	13935	19.22447470	10.35460627	1.74600000	44.54000000
EXPSQ	13935	476.79060458	416.95602675	3.04851600	1983.81160000
TENURE	13935	16.52545361	10.08012837	0.99700000	42.50200000
TENSQ	13935	374.69227592	360.56486540	0.99300000	1806.45400000
SERVGD	13935	4.39437417	4.53928241	0.01100000	26.91000000
SERVGDSQ	13935	45.77650901	87.81040338	0.00200000	724.31000000
BA	13935	0.61715106	0.48609936	0.00000000	1.00000000
MA	13935	0.20021529	0.40017573	0.00000000	1.00000000
PHD	13935	0.18263366	0.38637976	0.00000000	1.00000000
WDEG	13935	0.15062792	0.35769866	0.00000000	1.00000000
PRATE	13935	3.63351274	0.84924124	1.00000000	5.00000000
MKT	13935	0.17509867	0.38006512	0.00000000	1.00000000
RES	13935	0.15543595	0.36233277	0.00000000	1.00000000
OPT	13935	0.22877646	0.42006006	0.00000000	1.00000000
MAN	13935	0.26795838	0.44291169	0.00000000	1.00000000
PER	13935	0.03415859	0.18164292	0.00000000	1.00000000
APC	13935	0.06824543	0.25217563	0.00000000	1.00000000
MISS	13935	0.07032652	0.25570567	0.00000000	1.00000000
GRAD13	13935	0.10168640	0.30224631	0.00000000	1.00000000
GRAD46	13935	0.31969860	0.46637647	0.00000000	1.00000000
GRAD79	13935	0.48001435	0.49961834	0.00000000	1.00000000
GRAD1012	13935	0.09860065	0.29813577	0.00000000	1.00000000
SAL81	13935	3183.35888052	849.01538081	975.00000000	7025.00000000
NCHIL18	13935	1.06329386	1.14895297	0.00000000	5.00000000
MAR	13935	0.88697524	0.31663442	0.00000000	1.00000000
ENG	13935	0.46724076	0.49894358	0.00000000	1.00000000
SCI	13935	0.29465375	0.45590332	0.00000000	1.00000000
COM	13935	0.00846789	0.09163397	0.00000000	1.00000000
LAW	13935	0.00861141	0.09240058	0.00000000	1.00000000
BUS	13935	0.17294582	0.37821400	0.00000000	1.00000000
OTH	13935	0.04808037	0.21394377	0.00000000	1.00000000

TABLE 2B
SIMPLE STATISTICS FOR BLACK MALE EMPLOYEES
EXCLUDING SEPERATIONS

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	436	0.11926606	0.32447363	0.00000000	1.00000000
EXP	436	11.35996789	6.83680761	1.74600000	43.74800000
EXPSQ	436	175.68360247	217.79268982	3.04851600	1913.88750400
TENURE	436	7.71912615	5.12418842	0.99900000	28.52300000
TENSQ	436	85.78208257	103.91994197	0.99900000	813.55800000
SERVGD	436	2.83488532	2.57965735	0.08200000	13.63000000
SERVGDSQ	436	14.67563761	25.18925515	0.00700000	185.75000000
BA	436	0.66055046	0.47406646	0.00000000	1.00000000
MA	436	0.25229358	0.43482777	0.00000000	1.00000000
PHD	436	0.08715596	0.28238750	0.00000000	1.00000000
WDEG	436	0.14678899	0.35430198	0.00000000	1.00000000
PRATE	436	3.18119266	0.78298835	1.00000000	5.00000000
MKT	436	0.19495413	0.39662049	0.00000000	1.00000000
RES	436	0.07339450	0.26108252	0.00000000	1.00000000
OPT	436	0.24082569	0.42807589	0.00000000	1.00000000
MAN	436	0.31880734	0.46654953	0.00000000	1.00000000
PER	436	0.08486239	0.27899694	0.00000000	1.00000000
APC	436	0.07798165	0.26845074	0.00000000	1.00000000
MISS	436	0.00917431	0.09545177	0.00000000	1.00000000
GRAD13	436	0.33486239	0.47248449	0.00000000	1.00000000
GRAD46	436	0.47477064	0.49993672	0.00000000	1.00000000
GRAD79	436	0.16284404	0.36964747	0.00000000	1.00000000
GRAD1012	436	0.02752294	0.16378936	0.00000000	1.00000000
SAL81	436	2450.77981651	578.13609515	1450.00000000	5425.00000000
NCHIL18	436	1.16743119	1.09626065	0.00000000	5.00000000
MAR	436	0.82798165	0.37782993	0.00000000	1.00000000
ENG	436	0.28440367	0.45164818	0.00000000	1.00000000
SCI	436	0.30504587	0.46095578	0.00000000	1.00000000
COM	436	0.02981651	0.17027621	0.00000000	1.00000000
LAW	436	0.01376147	0.11663314	0.00000000	1.00000000
BUS	436	0.22477064	0.41791072	0.00000000	1.00000000
OTH	436	0.14220183	0.34965824	0.00000000	1.00000000

TABLE 2C
SIMPLE STATISTICS FOR WHITE FEMALE EMPLOYEES
EXCLUDING SEPERATIONS

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE
PROM	1045	0.24976077	0.43308176	0.00000000	1.00000000
EXP	1045	10.06013589	8.97657174	1.74600000	44.97600000
EXPSQ	1045	181.70806526	327.96434368	3.04851600	2022.84057600
TENURE	1045	7.01708038	7.74593390	0.99900000	44.33100000
TENSQ	1045	109.18172727	250.52099549	0.99900000	1965.26200000
SERVGD	1045	1.93179809	2.27988580	0.01200000	22.84000000
SERVGDSQ	1045	9.06214737	30.69470366	0.00200000	521.50000000
BA	1045	0.69186603	0.46194332	0.00000000	1.00000000
MA	1045	0.21722488	0.41255436	0.00000000	1.00000000
PHD	1045	0.09090909	0.28761744	0.00000000	1.00000000
WDEG	1045	0.09473684	0.29299133	0.00000000	1.00000000
PRATE	1045	3.64306220	0.82226104	2.00000000	5.00000000
MKT	1045	0.22296651	0.41643534	0.00000000	1.00000000
RES	1045	0.15023923	0.35747684	0.00000000	1.00000000
OPT	1045	0.26124402	0.43952297	0.00000000	1.00000000
MAN	1045	0.19138756	0.39358175	0.00000000	1.00000000
PER	1045	0.05550239	0.22906787	0.00000000	1.00000000
APC	1045	0.11291866	0.31664488	0.00000000	1.00000000
MISS	1045	0.00574163	0.07559186	0.00000000	1.00000000
GRAD13	1045	0.46698565	0.49914775	0.00000000	1.00000000
GRAD46	1045	0.40861244	0.49181275	0.00000000	1.00000000
GRAD79	1045	0.11196172	0.31547033	0.00000000	1.00000000
GRAD1012	1045	0.01244019	0.11089274	0.00000000	1.00000000
SAL81	1045	2209.13397129	534.81173617	750.00000000	5875.00000000
NCHIL18	1045	0.23157895	0.62664182	0.00000000	5.00000000
MAR	1045	0.52535885	0.49959561	0.00000000	1.00000000
ENG	1045	0.18851675	0.39131153	0.00000000	1.00000000
SCI	1045	0.38181818	0.48606496	0.00000000	1.00000000
COM	1045	0.07655502	0.26601140	0.00000000	1.00000000
LAW	1045	0.01148325	0.10659391	0.00000000	1.00000000
BUS	1045	0.17990431	0.38429164	0.00000000	1.00000000
OTH	1045	0.16172249	0.36837234	0.00000000	1.00000000

separation and promotion probabilities. Females are promoted in significantly greater proportions than males with the respective means being 25% and 12.5%. Females also separate in significantly greater proportions than white males and white males separate in significantly greater proportions than black males. For females the separation rates are 9.2%, for white males 7.7% and for black males 5.8%.

Appendix tables A1, A2 and A3 are a more detailed breakdown of the distribution of promotions in this firm. These tables contain the sample of employees who stayed in the firm the entire year (1982). What they illustrate is that the probability of promotion declines with years of experience, or tenure, for all three demographic groups. This relationship is apparent for all salary grade levels combined and within salary grade level. With regard to experience (tenure) in salary grade, there seems to be a U-shaped relationship between promotions and this variable. The probability of promotion rises quickly and then falls continuously over the years of experience in salary grade. This relationship appears to hold at all levels of disaggregation. Also illustrated in these tables is the fact that promotion probabilities increase with performance rating, and again this result is obtained for all salary grades combined and within salary grade level for each of the race/gender samples. Finally tables A1, A2 and A3 show that

the probability of promotion falls drastically as employees rise in the firm hierarchy. This fact is a partial explanation of the large differences in mean promotion probabilities between white males and females. Females, and black males, are concentrated in the lower salary grade levels.

Similar to tables A1, A2 and A3, a more detailed breakdown of separation probabilities are contained in tables A4, A5 and A6 of the appendix. These tables contain the sample of all employees (leavers and stayers). Separation probabilities first decline and then rise with either experience or tenure. This is a robust observation that is consistent with many other analyses. The separation probabilities increase in the later years of experience (tenure) reflecting the effects of retirement. For white males and females the separation probability increases throughout the range of experience in salary grade while for black males it is declining. For all three groups the separation rate declines with performance rating although black males and females show an increase in separation rates at the highest performance level. This result is consistent with a market characterized by an affirmative action oriented group of firms where there is intense competition for qualified minorities. The last point to mention regarding separation rates is that for white males they decline and then rise over the salary grade levels while for black males and

females it declines nearly continuously. The following section will present the results of the multivariate analyses.

ESTIMATION RESULTS

The first analysis to be reviewed is the simple promotions model or equation #3a of the text. Tables 3 and 4 contain these estimates. Table 3 lists the results for the separate race and gender groups while table 4 contains the results for two combined analyses; white and black males and white males and females. The models of table 4 were estimated in order to provide an approximate measure of discrimination between the majority (white males) and minority (black males and females) groups.

Looking at the results for white males, table 3 column 1, we notice that the probability of being promoted is primarily dependent upon the employee's salary grade level, performance rating and experience in salary grade. It is not surprising to find that salary grade level is an important predictor of promotion probabilities since the number of available positions will naturally decline given the pyramidal structure of this and most firms. Equally unremarkable is the result that performance rating is a strong predictor of the probability of being promoted. It was argued above that the firm ranks employees on the basis

of relative performance when choosing individuals for promotion so it is not surprising to find that a measure of relative job performance (i.e. performance ratings) has a large positive effect on the probability of being promoted. Calculated at the mean values for the sample an additional point on the rating scale will increase the probability of being promoted by 8.2%²¹. The affect of experience in salary grade on promotion probabilities is positive over the entire range of sample values. At the mean values an additional year of experience in grade increases the probability of being promoted by 0.3%. An individual with one standard deviation more experience in salary grade than the average will have an 1.4% higher probability of being promoted. As for the other measures of experience, tenure [TENURE] with the firm is insignificant and total labor market experience [EXP] is negative and significant. An additional year of total labor market experience decreases the probability of being promoted by .2%. The affects of total labor market experience are not linear however and after 33 years an additional year of experience increases the promotion probability. In terms of general and specific training the returns to general training are those associated with the total labor market experience [EXP] variable. The returns to firm specific training are those associated with tenure [TENURE] and the returns to job specific training are those

associated with experience in salary grade [SERVGD]. It is important to note that when discussing the results in the general/specific training framework the returns are the individual coefficients associated with the appropriate variable as outlined previously. Thus for job specific training, an additional year increases the probability of being promoted by 0.7%. Compare this to the 0.3% increase for an additional year spent in the same salary grade. The two measures differ because the time spent in salary grade includes both general and specific training components [function of all experience coefficients].

Other important predictors of the probability of being promoted are a few of the functional group dummies [MKT, APC and MISS] and the dummy variable indicating whether or not a person received a degree while working. The reference group in regard to the functional groups is operations. Thus those individuals in the marketing, audit/control and missing categories are more likely to be promoted than the employees in operations. Receiving an additional degree while working for the firm increases the probability of being promoted by approximately 1.7%.

The results for white males appear to suggest that besides salary grade level the most important determinant of promotions is performance. The positive role of job specific training is consistent with the notion that such training

raises the productivity (thus the ranking) of the employee and thus the probability of promotion. The negative affect of general training however is somewhat counter intuitive. One usually assumes that general training would also increase productivity and the probability of promotion. One explanation of this is that total experience might be a proxy for unobserved ability when holding salary grade constant (Landau and Weiss 1985). Thus the more experienced employees in a salary grade might also be the less able or else they would have been promoted previously. Another explanation is that the more experienced employees with a large amount of general training, have more outside opportunities available to them and would be more likely to leave the firm. The firm would then lose the investment costs associated with promotions. The positive return to obtaining an additional degree while employed with the firm is consistent with the human capital predictions regarding investments in performance enhancing activities. Finally the significant differences in promotion probabilities across functional groups implies that the internal labor market of the firm is segmented. The segmentation can take the form of non-transferrability of skills across groups or can be the result of information costs which inhibit the identification of either candidates or jobs.

Looking at column 2, table 3, the results of the female sample are listed. The findings are very similar for those of white males in that salary grade level, performance ratings and experience in salary grade are the primary predictors of promotion probabilities. The receipt of an additional degree while working is also important but the functional group dummies are insignificant. It is also noteworthy that the general experience term [EXP] is also insignificant.

An additional point on the performance rating scale increases a women's chances of promotion by 18%. This is similar to white males. The return to job specific training [SERVGD] results in an increase of 10.4% in the promotion probability for each additional year of such training. This is a very large affect which is approximately fifteen times the size of that of the white male sample. It is non-linear however and an additional year of job specific training for a women with six years of experience in salary grade actually lowers the probability of promotion. This implies that women are really on a fast track of this firm. They are in a salary grade for a short period and then moved up. The return to receiving an additional degree while working [WDEG] is also much stronger for women than men. The affect of this variable is to increase a women's chance of promotion by 10% while the comparable figure was 1.7% for white males.

Table 4, column 1 contains the results of a combined analysis for white males and females. The coefficient on the female [FEMALE] dummy variable is insignificant which provides some evidence that white males and females have similar experiences at this firm, although some difference were noted above in regard to a few variables.

Finally, for table 3, column 3 details the results of the black male sample. As was the case for both white males and females the salary grade level and performance rating of the employee are prominent predictors of the promotion probability. Experience in salary grade, or job specific training, is not significant among the black male sample, and neither is the dummy variable indicating a receipt of an additional degree while working. What is interesting about this sample is the significance of the degree of study variables. Black male employees who received degrees in engineering, the physical sciences and/or computing have a significantly higher probability of being promoted than those employees in the "other" category. It appears that there is a high demand in this company for black employees with technical degrees. This result is consistent with what would be expected of a firm involved in affirmative action programs, especially since these degrees were not significant contributors to the white male's promotion chances. Of course this result could be due to the

TABLE 3
SIMPLE PROMOTIONS MODEL FOR WHITE MALES, BLACK MALES AND FEMALES

WHITE MALES		BLACK MALES		FEMALES	
Log-Likelihood.....	-4187.6	Log-Likelihood.....	-123.6	Log-Likelihood.....	-464.5
Restricted Log-L....	-5273.8	Restricted Log-L....	-159.3	Restricted Log-L....	-587.4
Chi-Squared.....	2172.4	Chi-Squared.....	71.5	Chi-Squared.....	245.7
Degrees of Freedom...	24	Degrees of Freedom..	24	Degrees of Freedom..	24
Significance Level..	0.321E-13	Significance Level..	0.128E-5	Significance Level	0.321E-13

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Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)
ONE	-2.72	-21.831 (0.000)	ONE	-5.18	-6.245 (0.000)	ONE	-3.81	-10.544 (0.000)
EXP	-0.327E-01	-2.938 (0.003)	EXP	0.865E-01	1.339 (0.188)	EXP	-0.447E-02	-0.122 (0.902)
EXPSQ	0.532E-03	1.938 (0.052)	EXPSQ	-0.274E-02	-1.322 (0.186)	EXPSQ	-0.173E-02	-1.287 (0.197)
TENURE	0.712E-02	0.615 (0.538)	TENURE	-0.539E-01	-0.578 (0.563)	TENURE	-0.392E-01	-1.002 (0.316)
TENSQ	-0.789E-03	-2.453 (0.014)	TENSQ	0.411E-03	0.086 (0.931)	TENSQ	0.206E-02	1.391 (0.164)
SERVGD	0.575E-01	7.044 (0.000)	SERVGD	0.194	1.599 (0.109)	SERVGD	0.624	7.619 (0.000)
SERVGDSD	-0.448E-03	-1.013 (0.311)	SERVGDSD	-0.102E-01	-0.861 (0.389)	SERVGDSD	-0.521E-01	-5.563 (0.000)
MA	0.612E-01	1.374 (0.169)	MA	0.109	0.427 (0.669)	MA	-0.119E-01	-0.091 (0.927)
PHD	0.883E-01	1.408 (0.158)	PHD	0.377	0.730 (0.465)	PHD	-0.183	-0.767 (0.443)
WDEG	0.137	2.767 (0.005)	WDEG	0.392	1.256 (0.209)	WDEG	0.428	2.502 (0.012)
PRATE	0.612	28.516 (0.000)	PRATE	0.820	5.745 (0.000)	PRATE	0.740	10.782 (0.000)
MKT	0.137	2.705 (0.006)	MKT	0.145	0.472 (0.636)	MKT	0.153	1.082 (0.279)
RES	0.308E-01	0.498 (0.618)	RES	-0.900	-1.581 (0.113)	RES	-0.145E-01	-0.082 (0.934)
MAN	-0.706E-03	-0.016 (0.987)	MAN	0.224E-01	0.091 (0.927)	MAN	0.221	1.352 (0.176)
PER	0.465E-01	0.487 (0.626)	PER	0.300	0.789 (0.430)	PER	0.115	0.483 (0.629)
APC	0.202	2.950 (0.003)	APC	0.360	0.847 (0.397)	APC	0.427E-01	0.221 (0.824)
MISS	0.256	3.347 (0.000)	MISS	-3.77	-0.040 (0.967)	MISS	0.360	0.528 (0.597)
GRAD46	-0.558	-10.616 (0.000)	GRAD46	-0.412	-1.681 (0.092)	GRAD46	-0.579	-4.499 (0.000)
GRAD79	-1.12	-16.426 (0.000)	GRAD79	-1.13	-2.590 (0.009)	GRAD79	-0.811	-3.534 (0.000)
GRAD1012	-1.00	-11.116 (0.000)	GRAD1012	-0.537	-0.709 (0.478)	GRAD1012	0.262	0.582 (0.560)
ENG	0.121	1.622 (0.104)	ENG	1.29	3.166 (0.001)	ENG	0.104	0.526 (0.598)
SCI	0.880E-01	1.140 (0.254)	SCI	0.903	2.265 (0.023)	SCI	0.565E-01	0.357 (0.721)
COM	0.191	1.276 (0.201)	COM	1.30	2.247 (0.024)	COM	0.142	0.653 (0.513)
LAW	0.153	0.816 (0.414)	LAW	0.862	1.022 (0.306)	LAW	0.285	0.582 (0.560)
BUS	0.409E-01	0.524 (0.600)	BUS	0.362	0.848 (0.396)	BUS	0.206E-01	0.113 (0.910)

TABLE 4
SIMPLE PROMOTION MODEL FOR COMBINED RACE AND GENDER GROUPS

WHITE MALES AND FEMALES

Log-Likelihood.....	-4689.9
Restricted (Slopes=0) Log-L.	-5915.2
Chi-Squared.....	2450.8
Degrees of Freedom.....	25
Significance Level.....	0.32173E-13

WHITE AND BLACK MALES

Log-Likelihood.....	-4326.0
Restricted (Slopes=0) Log-L.	-5433.3
Chi-Squared.....	2214.5
Degrees of Freedom.....	25
Significance Level.....	0.32173

Variable Coefficient T-ratio (Sig)

Variable	Coefficient	T-ratio	(Sig)
ONE	-2.73	-23.559	(0.00000)
EXP	-0.325E-01	-3.163	(0.00156)
EXPSQ	0.436E-03	1.690	(0.09105)
TENURE	0.003E-02	0.742	(0.45799)
TENSQ	-0.728E-03	-2.388	(0.01693)
SERVBD	0.641E-01	7.748	(0.00000)
SERVBDSD	-0.764E-03	-1.692	(0.09072)
MA	0.562E-01	1.342	(0.17967)
PHD	0.812E-01	1.362	(0.17329)
WDEB	0.153	3.243	(0.00118)
PRATE	0.610	30.091	(0.00000)
MKT	0.132	2.785	(0.00515)
RES	0.242E-01	0.419	(0.67492)
MAN	0.739E-02	0.171	(0.86432)
PER	0.506E-01	0.576	(0.56433)
APC	0.178	2.781	(0.00542)
MISS	0.244	3.239	(0.00120)
GRAD46	-0.555	-11.638	(0.00000)
GRAD79	-1.11	-17.401	(0.00000)
GRAD1012	-0.978	-11.358	(0.00000)
ENG	0.112	1.668	(0.09537)
SCI	0.843E-01	1.235	(0.21684)
COM	0.155	1.301	(0.19322)
LAW	0.177	1.028	(0.30304)
BUS	0.302E-01	0.433	(0.66518)
FEMALE	0.331E-01	0.637	(0.52440)

Variable Coefficient T-ratio (Sig)

Variable	Coefficient	T-ratio	(Sig)
ONE	-2.79	-22.657	(0.00000)
EXP	-0.287E-01	-2.642	(0.00823)
EXPSQ	0.446E-03	1.655	(0.09798)
TENURE	0.311E-02	0.276	(0.78240)
TENSQ	-0.697E-03	-2.209	(0.02718)
SERVBD	0.576E-01	7.103	(0.00000)
SERVBDSD	-0.451E-03	-1.022	(0.30693)
MA	0.614E-01	1.405	(0.15990)
PHD	0.917E-01	1.480	(0.13877)
WDEB	0.146	2.992	(0.00277)
PRATE	0.614	29.051	(0.00000)
MKT	0.137	2.756	(0.00585)
RES	0.137E-01	0.225	(0.82175)
MAN	-0.589E-03	-0.013	(0.98955)
PER	0.636E-01	0.692	(0.48890)
APC	0.205	3.039	(0.00230)
MISS	0.249	3.262	(0.00111)
GRAD46	-0.539	-10.576	(0.00000)
GRAD79	-1.11	-16.597	(0.00000)
GRAD1012	-0.980	-11.047	(0.00000)
ENG	0.162	2.223	(0.02620)
SCI	0.124	1.657	(0.09759)
COM	0.241	1.687	(0.09162)
LAW	0.174	1.066	(0.28643)
BUS	0.578E-01	0.759	(0.44788)
BLACK	-0.151	-1.727	(0.08423)

characteristics of the reference group in this sample. The last point in regard to the black male sample is that job specific experience [SERVGD] approaches the .10 significance level and has a positive influence on the promotion probability. An additional year of job specific training increases the promotion probability by approximately 1.5% which is about twice as large as that for white men.

A combined analysis including black and white males was estimated and the results are listed in table 4, column 2. The coefficient on the dummy variable indicating whether or not an employee is black [BLACK] was insignificant. It is thus reasonable to conclude that the experiences of all male employees were similar.

Before leaving the simple promotions model we can review the results obtained from estimating this model by individual salary grade level groups. From this analysis we can examine whether or not the factors that determine promotion probabilities vary across grade levels. We might expect to find different affects if there is a likelihood that the firm uses a different set of criteria to select employees depending on their position in the firm hierarchy. For example, at the highest grade levels we might expect to find that certain functional groups such as marketing and finance (audit/control) increase the probability of promotion. It is often observed that upper level managers are

drawn from these types of organizational groups. Another example might be in regard to the affects of obtaining an additional degree on the job. This achievement will probably be more important at lower levels of management as opposed to the very top positions. The answer to these types of questions can be addressed by the analysis contained in table 5. The results of table 5 are for white males employees.

An interesting result of the analysis in table 5 is that the number of statistically significant variables declines as we move up through the grade levels to the point where performance rating is the only significant predictor of promotions for grade levels 10-12. This implies that the firm is narrowing its selection criteria to basically one indicator. The other (insignificant) variables that at lower levels provide information to the firm are no longer given much weight at the upper salary grade levels. One reason for this result is that those employees in the upper level positions have been with the firm for a longer duration (23.7 vs. 6.1 years) and the information summarized by the performance rating is more reliable and less likely to be supplemented with other indicators. It is also the case that in the upper grade levels that many of the variables other than performance rating exhibit much less variance than in the lower grades. That is the sample is becoming more homogenous as you move up the salary grade scale.

Consistent with the above result is the behavior of several of the individual coefficients. The affects of the education level dummies (MA, PhD) show monotonic declines as you move up the job hierarchy which again illustrates the early importance of these indicators. Engineers seem to quickly gain promotions relative to non-engineers but the affect diminishes drastically at higher salary grade levels. The same result holds for a computer degree. Among the functional group dummies the results are mixed with no clear trends identifiable in table 5. Employees in marketing and personnel do seem to have some advantage in being promoted, relative to employees in operations, as you move up the hierarchy but this trend is not monotonic. The final point of interest in table 5 is in regard to the coefficient of the general experience [EXP] variable. This variable becomes more negative and more significant as you move into the upper level positions. This result is consistent with the notion that experience becomes a proxy for ability and older, more experienced employees are less able (i.e peaked out) than younger less experienced employees at the same level. Or the result could be attributable to the fact that many older, more experienced employees, will be retiring soon and that due to the increased costs of promoting such an individual the firm chooses the younger employee. In this sense the younger employee is a better investment.

TABLE 5
SIMPLE PROMOTIONS MODEL FOR WHITE MALES BY SALARY GRADE

SALARY GRADES 1-3			SALARY GRADES 4-6			SALARY GRADES 7-9			SALARY GRADES 10-12		
Log-Likelihood...	-788.3		Log-Likelihood...	-1679.0		Log-Likelihood...	-1346.7		Log-Likelihood....	-301.8	
Restricted Log-L..	909.2		Restricted Log-L.	-2004.8		Restricted Log-L.	-1598.7		Restricted Log-L.	-355.8	
Chi-Squared.....	241.7		Chi-Squared.....	651.7		Chi-Squared.....	504.0		Chi-Squared.....	108.0	
Degrees of Freedom..	21		Degrees of Freedom..	21		Degrees of Freedom..	21		Degrees of Freedom..	21	
Significance Level..	0.00		Significance Level..	0.000		Significance Level..	0.000		Significance Level..	0.000	

Variable	Coeff	T-ratio	Variable	Coeff	T-ratio	Variable	Coeff	T-ratio	Variable	Coeff	T-ratio
ONE	-2.45	-9.041	ONE	-3.90	-10.037	ONE	-3.35	-10.930	ONE	-2.22	-2.961
EXP	-0.732E-03	-0.027	EXP	-0.217E-01	-1.299	EXP	-0.731E-01	-3.009	EXP	-0.509E-01	-0.803
EXPSQ	-0.141E-03	-0.172	EXPSQ	0.464E-03	1.058	EXPSQ	0.119E-02	2.241	EXPSQ	0.651E-03	0.494
TENURE	-0.691E-01	-1.952	TENURE	0.131E-01	0.778	TENURE	0.162E-01	0.705	TENURE	-0.154E-01	-0.299
TENSQ	0.537E-03	0.493	TENSQ	-0.829E-03	-1.643	TENSQ	-0.862E-03	-1.462	TENSQ	-0.183E-03	-0.146
SERVGD	0.131	4.575	SERVGD	0.753E-01	5.685	SERVGD	0.358E-01	2.907	SERVGD	0.665E-01	1.769
SERVGDSQ	-0.250E-02	-1.651	SERVGDSQ	-0.111E-02	-1.590	SERVGDSQ	0.687E-03	1.031	SERVGDSQ	-0.368E-02	-1.384
MA	0.211	1.864	MA	0.645E-01	0.934	MA	-0.123E-01	-0.158	MA	-0.560E-01	-0.323
PHD	1.23	1.280	PHD	0.211	1.737	PHD	0.106	1.165	PHD	-0.117	-0.622
WDEG	-0.497E-01	-0.273	WDEG	0.274	3.246	WDEG	0.132	1.735	WDEG	0.109	0.673
FRATE	0.496	10.376	PRATE	0.707	20.698	PRATE	0.620	15.934	PRATE	0.537	6.474
MKT	0.247E-01	0.209	MKT	0.166	2.043	MKT	0.149	1.665	MKT	-0.291E-01	-0.143
RES	0.134E-01	0.081	RES	0.106	0.987	RES	-0.397E-01	-0.396	RES	-0.773E-01	-0.337
MAN	-0.107	-0.989	MAN	0.109	1.649	MAN	-0.116	-1.342	MAN	-0.315	-1.254
FLR	-0.478E-01	-0.155	PER	-0.287	-1.786	PER	0.186	1.221	PER	0.332	1.240
APC	0.305	1.848	APC	0.798E-01	0.759	APC	0.254	2.053	APC	0.316	1.258
MISS	1.53	2.006	MISS	0.364	2.067	MISS	0.226	1.978	MISS	0.146	0.766
ENG	0.481	3.156	ENG	0.691E-01	0.602	ENG	0.198E-01	0.112	ENG	-0.475	-1.717
SCI	0.223	1.518	SCI	-0.591E-02	-0.049	SCI	0.767E-02	0.042	SCI	-0.125	-0.434
COM	0.371	1.669	COM	0.240	1.010	COM	-0.262	-0.455	COM	-3.47	-0.039
LAW	-0.688	-0.639	LAW	0.173	0.463	LAW	0.506E-01	0.169	LAW	-0.495	-0.953
BUS	-0.353E-01	-0.236	BUS	0.926E-02	0.077	BUS	0.943E-01	0.515	BUS	-0.475	-1.596

This question will be further explored when reviewing the results of the reduced form estimates of the structural model.

It was argued that there is a substantial possibility for the estimates of tables 3-5 to be biased due to sample selection (attrition) criteria that have been ignored up to now. The estimates of tables 3-5 were re-estimated including a correction for this potential bias²². The correction, as outlined previously, involves estimating an equation predicting selection into the sample and then using this information to correct the promotions model. Two methods were used; the first, a method similar to the Heckman (1977, 1979) procedure for an OLS model and the second, a maximum likelihood technique. The selection equation was specified in a simple form that includes the exogenous variables of the promotions model and several additional variables that further identify the selection model. What is important to note is that this selection equation is not a reduced form of the structural model but should be interpreted as an index predicting sample status (inclusion or exclusion). The choice of estimating this simpler selection equation was made so that the relevance of the structural model could be ascertained and also to test whether or not the estimates of the promotions model are sensitive to the specified form of the selection equation. The results

of the selection equations are contained in appendix table B1.

Table 6 and 7 lists the results of the simple promotions model which attempts to correct for attrition bias problems. Table 6 contains the estimates from the two stage procedure and table 7 contains the maximum likelihood results. The findings of table 6 and 7 can be summarized by noting that the estimates of the correlation coefficient, LAMBDA in table 6 and RHO in table 7, between the errors of the selection and promotion equations is never significant. Also there does not appear to be much change in any of the coefficients that were significant in table 3. These results provide strong evidence to conclude that in this sample there does not appear to be a measurable problem attributable to attrition. Thus there are no significant unobserved affects that determine both promotions and separations (or staying). Previously, we had outlined some intuitive hypotheses regarding this possibility but the results are clear in rejecting these notions.

It was also argued previously that there was a potential bias in the tenure coefficient due to unobserved heterogeneity in the sample. The inclusion of the lambda correction term (table 6) should have served to reduce that bias if it did in fact exist. The lack of movement in the coefficients between tables 3 and 6 are evidence that this

TABLE 6
SIMPLE PROMOTIONS MODEL FOR WHITE MALES, BLACK MALES AND FEMALES
TWO STAGE CORRECTION FOR ATTRITION BIAS

WHITE MALES			BLACK MALES			FEMALES		
Log-Likelihood.....	-4186.9		Log-Likelihood.....	-123.0		Log-Likelihood.....	-464.2	
Restricted Log-L....	-5273.8		Restricted Log-L....	-159.3		Restricted Log-L....	-587.3	
Chi-Squared.....	2173.8		Chi-Squared.....	72.6		Chi-Squared.....	246.3	
Degrees of Freedom...	25		Degrees of Freedom...	25		Degrees of Freedom...	25	
Significance Level..	0.3217E-13		Significance Level..	0.154E-05		Significance Level..	0.321E-13	

Variable	Coefficient	T-ratio (Sig)	Variable	Coefficient	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)
ONE	-2.92	-16.096 (0.000)	ONE	-4.83	-4.568 (0.000)	ONE	-4.16	-7.505 (0.000)
EXP	-0.240E-01	-1.908 (0.056)	EXP	0.778E-01	1.166 (0.243)	EXP	0.619E-03	0.017 (0.986)
EXPSQ	0.245E-03	0.723 (0.469)	EXPSQ	-0.256E-02	-1.221 (0.222)	EXPSQ	-0.182E-02	-1.370 (0.170)
TENURE	0.113E-01	0.962 (0.336)	TENURE	-0.864E-01	-0.700 (0.483)	TENURE	-0.114E-01	-0.233 (0.816)
TENSQ	-0.928E-03	-2.786 (0.005)	TENSQ	0.999E-03	0.208 (0.835)	TENSQ	0.125E-02	0.722 (0.470)
SERVGD	0.580E-01	7.127 (0.000)	SERVGD	0.203	1.663 (0.096)	SERVGD	0.573	6.548 (0.000)
SERVDSQ	-0.494E-03	-1.122 (0.261)	SERVDSQ	-0.112E-01	-0.935 (0.349)	SERVDSQ	-0.494E-01	-5.358 (0.000)
MA	0.499E-01	1.112 (0.266)	MA	0.121	0.476 (0.634)	MA	-0.293E-01	-0.226 (0.820)
PHD	0.755E-01	1.190 (0.243)	PHD	0.405	0.708 (0.486)	PHD	-0.135	0.780 (0.435)
WDEB	0.156	3.120 (0.000)	WDEB	0.380	1.226 (0.220)	WDEB	0.451	2.639 (0.008)
PRATE	0.629	24.768 (0.000)	PRATE	0.761	4.314 (0.000)	PRATE	0.736	10.581 (0.000)
MKT	0.126	2.488 (0.012)	MKT	0.183	0.586 (0.557)	MKT	0.175	1.243 (0.213)
RES	0.403E-01	0.650 (0.515)	RES	-0.911	-1.623 (0.104)	RES	0.519E-01	0.279 (0.780)
MAN	0.111E-01	0.243 (0.807)	MAN	0.132E-01	0.054 (0.956)	MAN	0.195	1.215 (0.224)
PER	0.499E-01	0.525 (0.599)	PER	0.325	0.848 (0.396)	PER	0.159	0.661 (0.508)
APC	0.190	2.767 (0.005)	APC	0.338	0.796 (0.426)	APC	0.447E-01	0.238 (0.812)
MISS	0.268	3.481 (0.000)	MISS	-3.77	-0.040 (0.967)	MISS	0.379	0.562 (0.573)
GRAD46	-0.541	-10.266 (0.000)	GRAD46	-0.416	-1.707 (0.087)	GRAD46	-0.540	-4.266 (0.000)
GRAD79	-1.10	-16.113 (0.000)	GRAD79	-1.11	-2.553 (0.010)	GRAD79	-0.645	-2.542 (0.011)
GRAD1012	-0.976	-10.792 (0.000)	GRAD1012	-0.525	-0.694 (0.487)	GRAD1012	0.178	0.401 (0.688)
ENG	0.118	1.593 (0.111)	ENG	1.27	3.139 (0.001)	ENG	0.764E-01	0.391 (0.695)
SCI	0.869E-01	1.131 (0.258)	SCI	0.895	2.259 (0.023)	SCI	0.414E-01	0.268 (0.788)
COM	0.189	1.273 (0.202)	COM	1.27	2.211 (0.027)	COM	0.119	0.562 (0.574)
LAW	0.154	0.825 (0.409)	LAW	0.845	1.003 (0.315)	LAW	0.299	0.617 (0.536)
RUS	0.395E-01	0.509 (0.610)	RUS	0.355	0.834 (0.404)	RUS	0.114E-01	0.064 (0.948)
LAMBDA	0.511	1.378 (0.168)	LAMBDA	-1.23	-0.813 (0.416)	LAMBDA	1.15	0.850 (0.395)

TABLE 7
SIMPLE PROMOTIONS MODEL FOR WHITE MALES, BLACK MALES AND FEMALES
MAXIMUM LIKELIHOOD CORRECTION FOR ATTRITION BIAS

WHITE MALES			BLACK MALES *			FEMALES		
Log-Likelihood.....-7088.4						Log-Likelihood.... -778.52		
Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)
DNE	-2.77	-16.172 (0.000)	DNE	-3.77	-10.407 (0.000)	DNE	-3.77	-10.407 (0.000)
EXP	-0.302E-01	-2.295 (0.021)	EXP	-0.290E-02	-0.067 (0.946)	EXP	-0.290E-02	-0.067 (0.946)
EXPSQ	0.451E-03	1.267 (0.205)	EXPSQ	-0.166E-02	-0.957 (0.338)	EXPSQ	-0.166E-02	-0.957 (0.338)
TENURE	0.833E-02	0.705 (0.480)	TENURE	-0.237E-01	-0.540 (0.589)	TENURE	-0.237E-01	-0.540 (0.589)
TENSQ	-0.827E-03	-2.498 (0.012)	TENSQ	0.152E-02	0.830 (0.406)	TENSQ	0.152E-02	0.830 (0.406)
SERVGD	0.575E-01	9.740 (0.000)	SERVGD	0.571	8.086 (0.000)	SERVGD	0.571	8.086 (0.000)
SERVGDSD	-0.463E-03	-1.609 (0.107)	SERVGDSD	-0.489E-01	-7.986 (0.000)	SERVGDSD	-0.489E-01	-7.986 (0.000)
MA	0.584E-01	1.276 (0.201)	MA	-0.242E-01	-0.187 (0.851)	MA	-0.242E-01	-0.187 (0.851)
PHD	0.851E-01	1.351 (0.176)	PHD	-0.135	-0.565 (0.572)	PHD	-0.135	-0.565 (0.572)
WDEG	0.141	2.773 (0.005)	WDEG	0.412	2.420 (0.015)	WDEG	0.412	2.420 (0.015)
PRATE	0.616	26.514 (0.000)	PRATE	0.699	10.211 (0.000)	PRATE	0.699	10.211 (0.000)
MKT	0.134	2.648 (0.008)	MKT	0.155	1.149 (0.250)	MKT	0.155	1.149 (0.250)
RES	0.334E-01	0.524 (0.600)	RES	0.349E-01	0.208 (0.835)	RES	0.349E-01	0.208 (0.835)
MAN	0.221E-02	0.047 (0.962)	MAN	0.204	1.310 (0.190)	MAN	0.204	1.310 (0.190)
PER	0.461E-01	0.494 (0.621)	PER	0.135	0.568 (0.569)	PER	0.135	0.568 (0.569)
APC	0.198	2.886 (0.003)	APC	0.519E-01	0.272 (0.785)	APC	0.519E-01	0.272 (0.785)
MISS	0.261	3.367 (0.000)	MISS	0.366	0.482 (0.629)	MISS	0.366	0.482 (0.629)
GRAD46	-0.554	-9.853 (0.000)	GRAD46	-0.540	-4.319 (0.000)	GRAD46	-0.540	-4.319 (0.000)
GRAD79	-1.12	-15.865 (0.000)	GRAD79	-0.743	-3.295 (0.000)	GRAD79	-0.743	-3.295 (0.000)
GRAD1012	-0.997	-10.898 (0.000)	GRAD1012	0.196	0.485 (0.627)	GRAD1012	0.196	0.485 (0.627)
ENG	0.121	1.657 (0.097)	ENG	0.100	0.531 (0.595)	ENG	0.100	0.531 (0.595)
SCI	0.887E-01	1.182 (0.237)	SCI	0.656E-01	0.444 (0.657)	SCI	0.656E-01	0.444 (0.657)
COM	0.191	1.262 (0.206)	COM	0.162	0.751 (0.452)	COM	0.162	0.751 (0.452)
LAW	0.155	0.794 (0.427)	LAW	0.297	0.605 (0.545)	LAW	0.297	0.605 (0.545)
RUS	0.415E-01	0.543 (0.587)	RUS	0.421E-01	0.243 (0.807)	RUS	0.421E-01	0.243 (0.807)
RHO(1,2)	0.168	0.315 (0.752)	RHO(1,2)	0.989	0.741 (0.458)	RHO(1,2)	0.989	0.741 (0.458)

* The computer program(LIMDEP) would not converge after several attempts using a variety of algorithms and starting values.

form of heterogeneity is probably not present in this sample. The reason for this observation might be explained by the inclusion of many job and/or individual attributes in the model which are capturing the differences among employees.

The next set of empirical results is an application of a test devised by Abraham and Medoff (1983), used to identify the relative importance of seniority in the determination of promotions. The basis of the test is the well known results of specification error due to omitted variables. If the sign of the coefficient of the omitted variable is known and the covariance between the omitted variable and the variable of interest is also known, then the direction of the bias is known. In their case Medoff and Abraham hypothesize that performance ratings and seniority will be negatively related in a meritocratic setting since good performers will be promoted out of their salary grade and the covariation between the variables is being measured within salary grade. They also assume, benignly, that the sign of the performance rating coefficient is positive. Putting these results together and estimating a promotions model without performance should increase the coefficients associated with seniority. If the coefficients decrease, this is evidence that the promotion process is not totally based on merit and seniority could possibly have a signifi-

cant and positive role. Weiss and Landau (1985) have illustrated that the negative relationship between performance and seniority within grade can simply be an artifact of the distribution of ability among employees. The absence of observed ability can result in a type of sample selection bias. The point is that the hypothesized relationship offered by Medoff and Abraham might be a result of a statistical bias as opposed to a theoretical point. The power of the test is not its strong point and with this in mind a look at table 8 will illustrate the results of this test for the present sample.

Table 8 contains the estimates for white males (column 1), black males (column 2) and females (column 3). Starting with the white males, and looking at the affects of an additional year of tenure, we see that the affect decreases by 32% which is consistent with the Abraham and Medoff hypothesis. The total affect (in absolute terms) of an additional year of service with the firm goes from -.032 to 0.042 between column 1 of table 3 and column 1 of table 8. This result is further supported if we examine how the affect of an additional year of experience in salary grade changes. The total affect decreases 126% and goes from .021 to -.006. In this case the affect actually changes sign which again agrees with the results obtained by Abraham and Medoff (1983). These results seem to be additional evidence

that seniority has a positive affect on promotion probabilities independent of performance. The simple model of a "rank order tournament" of promotions, where past performance is the sole determining criteria is inconsistent with the above results if we accept the foundations of the test.

Column 2 of table 8 lists the results for black males. Again the results are consistent with those of Abraham and Medoff although not as pronounced as was the case for white males. The total affect of an additional year of tenure decreases from $-.024$ to $-.022$ and the affect of an additional year of experience in salary grade decreases from $.113$ to $.022$. These comparisons are between column 2 of table 3 and column 2 of table 8.

Finishing the discussion of the results of table 8, column 3 lists the estimates for the female sample. The following comparisons are in reference to the appropriate column of table 3. The results for this sample are not uniform in that the affect of an additional year of tenure increases while the affect of an additional year of experience in salary grade decreases. The movement in the coefficients is relatively small however. The results for the female sample does not provide enough evidence to alter the general conclusion regarding hypothesis of interest. It appears that seniority plays an important role in the promotion decision and its affect is independent of performance.

TABLE B
APPLICATION OF ABRAHAM AND MEDOFF TEST FOR SIMPLE PROMOTIONS MODEL

WHITE MALES

Log-Likelihood..... -4648.8
 Restricted Log-L..... -5273.8
 Chi-Squared..... 1250.1
 Degrees of Freedom.... 23
 Significance Level... 0.32173E-13

BLACK MALES

Log-Likelihood..... -143.2
 Restricted Log-L..... -159.3
 Chi-Squared..... 32.3
 Degrees of Freedom.... 23
 Significance Level. 0.940E-01

FEMALES

Log-Likelihood..... -531.5
 Restricted Log-L..... -587.4
 Chi-Squared..... 111.7
 Degrees of Freedom.... 23
 Significance Level. 0.321E-13

Variable	Coeff	T-ratio (Sig)
DNE	-0.329	-3.770 (0.000)
EXP	-0.464E-01	-4.394 (0.000)
EXPSO	0.546E-03	2.098 (0.035)
TENURE	0.872E-02	0.802 (0.422)
TENSO	-0.770E-03	-2.547 (0.010)
SERVSD	0.442E-01	6.070 (0.000)
SERVSDSO	-0.514E-03	-1.503 (0.192)
MA	0.237E-01	0.563 (0.573)
FHD	0.456E-01	0.767 (0.443)
MDEG	0.174	3.706 (0.000)
MKT	0.137	2.853 (0.004)
RES	0.521E-01	0.875 (0.370)
MAN	-0.138E-01	-0.327 (0.747)
PER	0.579E-01	0.636 (0.524)
APC	0.181	2.786 (0.003)
MISB	0.239	3.328 (0.000)
GRAD46	-0.345	-6.943 (0.000)
GRAD79	-0.705	-11.140 (0.000)
GRAD1012	-0.482	-5.763 (0.000)
END	0.550E-01	0.775 (0.438)
SCI	0.286E-01	0.391 (0.696)
CUM	0.157	1.116 (0.264)
LAW	0.173E-01	0.097 (0.922)
RUS	0.265E-01	0.364 (0.716)

Variable	Coeff	T-ratio (Sig)
DNE	-1.81	-3.721 (0.000)
EXP	0.506E-01	0.819 (0.412)
EXPSO	-0.201E-02	-0.747 (0.343)
TENURE	-0.378E-01	-0.446 (0.653)
TENSO	-0.247E-03	-0.057 (0.954)
SERVSD	0.440E-01	0.411 (0.680)
SERVSDSO	-0.840E-04	-0.008 (0.973)
MA	0.251E-01	0.151 (0.879)
FHD	0.210	0.469 (0.639)
MDEG	0.293	1.075 (0.300)
MKT	0.473E-01	0.165 (0.869)
RES	-0.832	-1.634 (0.102)
MAN	0.244E-01	0.115 (0.908)
PER	0.401	1.150 (0.250)
APC	0.480	1.236 (0.216)
MISB	-3.77	-0.038 (0.969)
GRAD46	-0.179	-0.802 (0.422)
GRAD79	-0.625	-1.604 (0.108)
GRAD1012	0.300	0.513 (0.607)
END	0.939	2.600 (0.009)
SCI	0.619	1.775 (0.075)
CUM	1.04	1.964 (0.049)
LAW	0.887	1.071 (0.284)
RUS	0.166	0.445 (0.656)

Variable	Coeff	T-ratio (Sig)
DNE	-0.764	-3.771 (0.000)
EXP	0.167E-02	0.049 (0.960)
EXPSO	-0.170E-02	-1.369 (0.170)
TENURE	-0.334E-01	-0.932 (0.351)
TENSO	0.170E-02	1.269 (0.204)
SERVSD	0.398	3.399 (0.000)
SERVSDSO	-0.371E-01	-4.271 (0.000)
MA	-0.419E-02	-0.034 (0.972)
FHD	-0.227	-1.026 (0.304)
MDEG	0.206	1.764 (0.077)
MKT	0.430E-01	0.333 (0.746)
RES	-0.417E-01	-0.250 (0.802)
MAN	0.793E-01	0.521 (0.602)
PER	-0.181	-0.791 (0.429)
APC	-0.120E-01	-0.071 (0.943)
MISB	-0.101	-0.158 (0.874)
GRAD46	-0.337	-2.848 (0.004)
GRAD79	-0.504	-2.374 (0.017)
GRAD1012	0.379	0.861 (0.388)
END	0.655E-01	0.351 (0.723)
SCI	0.144E-01	0.098 (0.922)
CUM	0.734E-01	0.363 (0.715)
LAW	0.232	0.483 (0.627)
RUS	0.863E-01	0.502 (0.615)

That is to say the standard on-the-job training hypothesis of human capital theory does not provide a totally satisfactory explanation of the contribution of seniority to the promotion decision. Of course this conclusion ultimately depends on the quality of the test.

All the results up to this point have pertained to a simple promotions model that has as its foundation the notion that past performance is the primary determinant of the promotion decision. It was pointed out however, that in the presence of some unknown costs associated with the promotion decision, it is necessary to consider the future value of the employees performance. The model used currently makes this future value of the employees performance. The model used currently makes this future value a function of expected tenure, although expected tenure itself is unobserved. Using a proxy for expected tenure, the propensity to stay with the firm, a structural model of promotions and separations is derived. The reduced form solution of the structural model is estimated and the results for the promotions model are listed in table 9. Appendix table B2 contains the reduced form estimates of the separations model.

The results of table 9 are almost identical to those of table 3. The only interesting result is that a higher salary lowers the probability of being promoted for women. Otherwise the estimates of table 9 are interesting

in that they are so close to those of table 3. The reduced form model as specified does not seem to identify the hypothesized structure underlying the promotion process. In particular, the failure to move the coefficient of the general experience [EXP] variable substantially toward zero (or to increase it positively) is evidence that the representation of the promotion process embodied in the structural model is inappropriate. A somewhat surprising result of the earlier models was the significant and negative effect of general experience [EXP] on the probability of being promoted for the white male sample. One usually assumes that the accumulation of human capital implied in this term would enhance productivity and thus the probability of promotion. The hypothesis put forth in this paper, that could explain this result, was this notion of costs of promotion. That is the firm would be more willing to promote a younger, less experienced employee since it would then have a better chance of recouping its investment in the individual due to the longer expected tenure of that employee versus the older, more experienced employee. If, in fact, younger, less experienced employees were more likely to separate from the firm, then one could say that the previous argument is faulty. An examination of table B2, column 1, shows that for white males younger employees (13 years or less experience) are more likely to stay with the firm. To conclude

TABLE 9
REDUCED FORM ESTIMATES OF PROMOTION MODEL FOR WHITE MALES, BLACK MALES AND FEMALES

WHITE MALES			BLACK MALES			FEMALES		
Log-Likelihood....	-4187.2		Log-Likelihood....	-123.2		Log-Likelihood....	-461.3	
Restricted Log-L..	-5273.8		Restricted Log-L..	-159.3		Restricted Log-L..	-587.4	
Chi-Squared.....	2173.3		Chi-Squared.....	72.4		Chi-Squared.....	252.2	
Degrees of Freedom..	27		Degrees of Freedom..	27		Degrees of Freedom..	27	
Significance Level..	0.32E-13		Significance Level	0.511E-05		Significance Level..	0.32E-13	
Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)	Variable	Coeff	T-ratio (Sig)
ONE	-2.73	-18.951 (0.000)	ONE	-5.60	-5.232 (0.000)	ONE	-3.24	-7.349 (0.000)
EXP	-0.354E-01	-3.056 (0.002)	EXP	0.860E-01	1.249 (0.211)	EXP	0.838E-02	0.226 (0.821)
EXPSQ	0.598E-03	2.101 (0.035)	EXPSQ	-0.279E-02	-1.207 (0.198)	EXPSQ	-0.193E-02	-1.449 (0.147)
TENURE	0.658E-02	0.564 (0.572)	TENURE	-0.479E-01	-0.512 (0.608)	TENURE	-0.198E-01	-0.497 (0.619)
TENSQ	-0.767E-03	-2.377 (0.017)	TENSQ	-0.605E-05	-0.001 (0.999)	TENSQ	0.159E-02	1.071 (0.284)
SERVGD	0.574E-01	6.966 (0.000)	SERVGD	0.172	1.368 (0.171)	SERVGD	0.664	7.927 (0.000)
SERVGDSQ	-0.444E-03	-0.996 (0.319)	SCRVGDSD	-0.823E-02	-0.673 (0.500)	SERVGDSQ	-0.559E-01	-5.878 (0.000)
MA	0.607E-01	1.350 (0.177)	MA	0.808E-01	0.309 (0.757)	MA	0.577E-01	0.428 (0.668)
PHD	0.860E-01	1.330 (0.183)	PHD	0.321	0.609 (0.542)	PHD	0.100E-01	0.040 (0.968)
WDEG	0.138	2.766 (0.005)	WDEG	0.425	1.325 (0.185)	WDEG	0.366	2.103 (0.035)
PRATE	0.611	28.003 (0.000)	PRATE	0.831	5.693 (0.000)	PRATE	0.766	10.931 (0.000)
MKT	0.137	2.701 (0.006)	MKT	0.138	0.448 (0.654)	MKT	0.164	1.149 (0.250)
RES	0.320E-01	0.518 (0.604)	RES	-0.913	-1.597 (0.110)	RES	-0.144E-01	-0.082 (0.934)
MAN	-0.529E-03	-0.012 (0.990)	MAN	0.180E-01	0.073 (0.942)	MAN	0.245	1.492 (0.135)
PER	0.458E-01	0.480 (0.631)	PER	0.325	0.846 (0.397)	PER	0.138	0.574 (0.566)
APC	0.200	2.925 (0.003)	APC	0.354	0.822 (0.410)	APC	0.302E-01	0.156 (0.876)
MISS	0.256	3.329 (0.000)	MISS	-3.59	-0.038 (0.969)	MISS	0.325	0.471 (0.637)
GRAD46	-0.561	-10.169 (0.000)	GRAD46	-0.520	-1.805 (0.071)	GRAD46	-0.426	-2.967 (0.003)
GRAD79	-1.13	-13.410 (0.000)	GRAD79	-1.40	-2.271 (0.023)	GRAD79	-0.379	-1.291 (0.196)
GRAD1012	-1.01	-7.305 (0.000)	GRAD1012	-1.12	-0.936 (0.349)	GRAD1012	1.04	1.875 (0.060)
MAR	0.194E-01	0.407 (0.684)	MAR	-0.150	-0.577 (0.563)	MAR	0.487E-01	0.498 (0.618)
NCHIL18	0.114E-01	0.703 (0.481)	NCHIL18	-0.189E-01	-0.190 (0.849)	NCHIL18	-0.625E-01	-0.716 (0.474)
SALB1	0.329E-05	0.062 (0.950)	SALB1	0.264E-03	0.639 (0.522)	SALB1	-0.515E-03	-2.406 (0.016)
ENG	0.122	1.625 (0.104)	ENG	1.30	3.164 (0.001)	ENG	0.257	1.214 (0.224)
SCI	0.891E-01	1.153 (0.248)	SCI	0.947	2.343 (0.019)	SCI	0.126	0.780 (0.435)
COM	0.191	1.280 (0.200)	COM	1.35	2.324 (0.020)	COM	0.256	1.143 (0.253)
LAW	0.159	0.847 (0.397)	LAW	0.952	1.118 (0.263)	LAW	0.243	0.495 (0.620)
BUS	0.412E-01	0.528 (0.597)	BUS	0.393	0.913 (0.361)	BUS	0.803E-01	0.432 (0.666)

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TABLE 10
 REDUCED FORM ESTIMATES OF PROMOTIONS MODEL FOR WHITE MALES, BLACK MALES AND FEMALES
 MAXIMUM LIKELIHOOD CORRECTION FOR ATTRITION BIAS

WHITE MALES
 Log-Likelihood..... -7083.2

BLACK MALES *

FEMALES
 Log-Likelihood..... -772.24

Variable	Coeff	T-ratio (Sig)
ONE	-2.78	-14.344 (0.000)
EXP	-0.332E-01	-2.447 (0.014)
EXPSQ	0.522E-03	1.427 (0.153)
TENURE	0.780E-02	0.646 (0.518)
TENSQ	-0.807E-03	-2.398 (0.016)
SERVGD	0.576E-01	9.730 (0.000)
SERVGDSQ	-0.456E-03	-1.584 (0.113)
MA	0.581E-01	1.255 (0.209)
PHD	0.831E-01	1.255 (0.209)
WDEG	0.142	2.761 (0.005)
PRATE	0.616	25.897 (0.000)
MKT	0.134	2.630 (0.008)
RES	0.331E-01	0.519 (0.603)
MAN	0.135E-02	0.029 (0.976)
PER	0.473E-01	0.507 (0.612)
APC	0.197	2.870 (0.004)
MISS	0.259	3.330 (0.000)
GRAD46	-0.557	-9.595 (0.000)
GRAD79	-1.12	-13.180 (0.000)
GRAD1012	-1.00	-7.203 (0.000)
MAR	0.225E-01	0.457 (0.648)
NCHIL18	0.115E-01	0.697 (0.485)
SALB1	0.212E-06	0.004 (0.996)
ENG	0.122	1.654 (0.098)
SCI	0.902E-01	1.196 (0.231)
COM	0.195	1.275 (0.202)
LAW	0.152	0.779 (0.436)
BUS	0.394E-01	0.515 (0.606)
RHO(1,2)	0.152	0.285 (0.775)

Variable	Coeff	T-ratio (Sig)
ONE	-3.26	-7.133 (0.000)
EXP	0.107E-01	0.244 (0.807)
EXPSQ	-0.186E-02	-1.052 (0.292)
TENURE	-0.491E-02	-0.109 (0.912)
TENSQ	0.106E-02	0.564 (0.572)
SERVGD	0.612	7.768 (0.000)
SERVGDSQ	-0.525E-01	-7.960 (0.000)
MA	0.566E-01	0.423 (0.672)
PHD	0.644E-01	0.247 (0.804)
WDEG	0.345	1.896 (0.057)
PRATE	0.727	9.572 (0.000)
MKT	0.166	1.197 (0.231)
RES	0.711E-02	0.041 (0.967)
MAN	0.210	1.322 (0.186)
PER	0.153	0.635 (0.525)
APC	0.314E-01	0.160 (0.872)
MISS	0.316	0.403 (0.686)
GRAD46	-0.395	-2.730 (0.006)
GRAD79	-0.329	-1.164 (0.244)
GRAD1012	0.977	1.842 (0.065)
MAR	0.707E-01	0.723 (0.469)
NCHIL18	-0.800E-01	-0.970 (0.332)
SALB1	-0.507E-03	-2.459 (0.013)
ENG	0.303	1.419 (0.155)
SCI	0.181	1.115 (0.264)
COM	0.302	1.313 (0.189)
LAW	0.261	0.504 (0.614)
BUS	0.148	0.783 (0.433)
RHO(1,2)	0.889	1.532 (0.125)

* The computer program(LIMDEP) would not converge after several attempts using a variety of algorithms and starting values.

the discussion, it appears that the structural model does not support the proposed hypothesis. The reduced form model of table 9 was reestimated with a correction for attrition bias. The adjustment procedures were the same as those for the simple promotions model. The results (table 10) obtained illustrated that there was no significant correlations in the error terms of the reduced form promotions model and a separations equation. An additional point to note is that the separations model used as the selection equation was the reduced form model of separations. So in addition to illustrating the lack of attrition bias, the results of table 10 also indicate that the estimates of the corrected model are not extremely sensitive to the specification of the selection equation.

CONCLUSIONS:

There have been several models estimated by a variety of methods for three race and gender groups which add up to a lot of results. The analyses shared many common points, however, especially in the interaction between the econometric problems which governed estimation methods and the theoretical considerations which motivated the model specification. In most instances the solutions to the econometric problems were intermingled with the theoretic developments. There were subtle differences in each model

estimated however, and although most of the theoretical expectations and econometric problems proved to be non-existent, the extensive analysis which the data were subjected, lend a measure of robustness to the following conclusions.

For all of the models and across all groups there were several consistent (not surprising) results. The pyramidal structure of the firm hierarchy was clearly important. The chances of promotion are greatly diminished as an employee moves up the hierarchy. The performance rating which an employee receives is also highly correlated with the probability of being promoted. The higher an employee's rating the better their chances of promotion. The affect of an additional year of experience in salary grade was also consistently positive and significant. Between the two measures (performance ratings and experience in grade) for white males, a one standard deviation increase in the performance rating scale raises the probability of being promoted by approximately 6.5% while a one standard deviation increase in the number of years in a salary grade increases the promotion probability by 1.3%. The performance rating affect is clearly the dominant characteristic of the two in the promotion process for white males. For females the comparative figures are approximately 14% and 23%. So for females the opposite conclusion is reached, or the affect of

an additional year in salary grade is the most important determinant.

These last results are interesting because they shed additional light on the differences in the promotion process across salary grade levels. As was noted earlier, a majority of women are in salary grades 1-3 and over 80% are in salary grades 1-6. For men the comparative figures are 10% for salary grades 1-3 and 44% for grades 1-6. Reviewing table 5, which contains the results of the promotions analysis by salary grade level for white males, illustrates that the relative importance of experience in salary grade declines as you move up the firm hierarchy and the relative importance of performance rating increases over the same range. The differences in the relative importance of these two variables among white males and females can be viewed in the same way as the differences in these two variables among salary grade levels for white males. The two sets of results are consistent and they demonstrate that there are differences in the criteria used for promotion decisions across grades. In the lower grades seniority at the grade level is an important determinant of promotions but its affect diminishes as an employee moves up the firm hierarchy. Combining this result with those of the application of the Abraham and Medoff test indicate that the underlying promotion process for lower grade levels is inconsistent with a simple model dependent upon past performance.

The only other variable that was consistently significant was the degree while working dummy variable. An employee who received a degree while with the firm increases their chances of promotion. This is an expected result but the exact reason why is ambiguous. It could represent the returns to specific training especially if the degree was job specific and paid for by the firm, or it could be the returns to general training if the degree was useful across many firms. Of course, it could be a combination of the two or simply a reflection of the unobserved motivation of the employee.

The current firm under study does not appear to engage in any discriminatory behavior. The dummy variables used to measure discrimination against black males and/or females were consistently insignificant. If anything the firm seems to be recently engaged in affirmative action programs. This is heuristically evidenced by the relatively shorter tenures of the minority groups which illustrate recent recruitment efforts.

The effects of some of the institutional characteristics of the firm and/or the employee are at times significant. The functional group dummies are important only in the white male sample with the employees in the marketing (sales) and auditing/control, enjoying greater promotion rates than employees in operations (and thus the other cate-

gories which had insignificant coefficients). The type of degree received was important only in the black male sample where employees in engineering and the physical sciences experienced higher than average promotion rates. These results support, to a limited degree, the notion that the firm has an internal labor market [ILM] that is organized along functional and occupational lines. It was also argued that these distinctions among employees might also represent differences in the costs associated with being promoted. This hypothesis cannot be clearly identified from these results but it is not inconsistent with what was observed since the functional groups and type of degree variables were at times significant.

With regard to the more methodological results, the first point of interest is that the attrition bias problem does not appear to be an important issue when estimating the parameters of a promotions model. Although the correlation coefficient between the errors of a promotion and separation equation was large at times, it was always statistically insignificant. Furthermore, the parameter estimates associated with the corrected promotions model rarely changed from those estimated in the simple model. This is a very surprising result especially with regard to the black male and female samples. The attrition bias argument has so much intuitive appeal to find out that it is unimportant is sur-

prising. It means that those people who leave the firm have no more or less of a likelihood to be promoted than those that stay due to any unobserved characteristics. This result is in opposition to a belief that affirmative action policies are affecting various sectors of the black or female population differently. If the excellent female performers were being bid away or being given special treatment by their own firm, this would have led to a more significant result.

The problem regarding the bias due to the endogeneity of tenure also proved to be a non-problem as tested by the previous analysis. When the probability of staying in the firm (or the lambda correction term) was added to the promotions model the coefficient on tenure, experience or any other variable was negligibly affected. Thus the unobserved person/job/match components hypothesized and evidenced in other studies were not observed presently. This result could be due to the greater level of detail in regard to the variables included in the model such as functional group, type of degree (occupation), salary grade level and performance rating which might effectively control for some of these usually unobserved components; or it could be due to the fact that this analysis looked at a single firm and much of the unobserved heterogeneity usually hypothesized is firm specific. Finally, the method of correcting for this problem might have been inadequate.

The most disappointing result, from this paper's perspective, was the lack of support for the hypothesis regarding the importance of unknown costs in the promotion decision. The reduced form estimates of the structural model brought no new information to the analysis of promotions. There are several possible reasons explaining this result. The first is that the wage for the position to be filled may not be fixed, but in fact is a flexible choice variable with a considerable range. If this was the case then the firm could offset any previously unknown costs by altering the wage. Although there are predetermined wage ranges for certain positions in this firm they might be sufficiently large to offset the occurrence of unknown costs. Secondly, it could be the case that the unanticipated costs of promotion are trivial and lack the magnitude to substantially enter the promotion decision. The third reason could be the presence of lifetime jobs. This firm maintains a relatively stable workforce at the management level where there is little turnover. In the white male sample nearly 70% of all separations were employees with 30 or more years of tenure with the firm. These separations were most likely due to retirement concerns since all employees in the sample were hired with at least a Bachelors degree (approx. 52 yrs of age or more). Thus, out of all white male employees probably only 2.3% left before retire-

ment. This is a very small percentage and the firm might not have to concern itself with the issue of costs. Finally, the model might suffer from being mis-specified since it wasn't derived in a rigorous fashion and/or the series of proxy variables used so prominently might have introduced an errors in variables bias to the analysis.

The research presented in this paper has raised several questions regarding the labor market experiences of individuals and firms and has attempted to answer a few of those questions. There has been a fair amount of success in this regard but it is obvious that many questions remain unanswered and need to be more aggressively pursued. The questions and answers have been both theoretical and methodological and there is ample room in each area for continued research.

The necessary linking of promotions and separations was illustrated from both a theoretical and statistical perspective. Some reasons were given to explain the results obtained presently. These reasons however are mostly testable hypotheses that data on different firms would be able to address. For example, the notion that firms with stable, lifetime employees would be less influenced by the link between promotions and separations could be tested by comparing firms with different separation rates. Also firms with narrowly specified salary ranges for positions could be

compared to firms with no salary range specifications. The current research has outlined several testable hypotheses based on a variety of firm and employee characteristics. Continued research in this area would be interesting and fruitful.

In general the current research has provided a detailed and informative description of the promotion process in a large bureaucratic firm. The analysis concentrated on salaried employees at the management level and the results obtained were a significant contribution to the field.

ENDNOTES

1. See Killingsworth and Reimers (1983); many of the ideas in the introduction are detailed in that paper.
2. The name is withheld for proprietary reasons.
3. The worker maximizes utility (expected wealth) by setting the marginal cost of effort (disutility from work) equal to the marginal benefit which in this case is the increase in expected utility (wealth) derived from the increased effort and increased probability of winning the contest (Naleboff and Stiglitz 1983, Lazear and Rosen 1981). This maximization procedure is characterized by Nash-Cournot assumptions.
4. Promotions in this paper are associated with a particular level of jobs.
5. As specified, all costs of promotion are the firm's responsibility. This could be modified by specifying W as a range over some interval. The wider the range, the more the possibility exists for the employee to absorb some of the costs, since the firm could then alter the wage. The firm will always bear the costs of recruitment and selection. Specific training costs might be shared (Becker 1975) although there is the issue of moral hazard (Carmichael 1983).
6. Although the Lazear and Rosen (1981) model is applicable, any "salary structure" (Wise 1975) that is imposed by the firm will serve the same purpose.
7. There is a trivial normalization of K to be 0 and the structural parameters are estimated to a factor of proportionality (Amemiya 1981, Maddalla 1983).
8. The equality of equation 4 holds only over the employee's life with the firm and not for a particular job (Lazear and Rosen 1981). The firm however, expects to recoup the job specific costs over the life of that job. Equation 4 can be modified to be the following:
$$c \leq \int E[VMP]e^{-ru} du - \alpha \int we^{-ru} du$$
where α is equal to the proportion of expected lifetime wage paid to the employee on this job.
9. See footnote 7.

10. The procedure as outlined by Van de Ven and Van Praag (1981) and Heckman (1979) is as follows:
- estimate probit of the probability of staying in the firm.
 - construct the inverse mills ratio and include it in an OLS regression of the promotions model.
 - use the estimate of the standard deviation of the error () term derived from the regression in step b to,
 - divide the right hand side variables of the promotion model, including the inverse mills ratio, by the in step c.
 - estimate probit of the probability of promotion which yields an estimate of the correlation coefficient between the selection and promotion equations.
11. Following Van de Ven and Van Praag (1981) the likelihood function is the following:

$$L = \prod_0 P_1^{Y_i} \prod_J P_2^{Y_j} \prod_K P_3^{Y_k}$$

where:

$$\begin{aligned} P_1 &= F(ax, bz, p) \\ P_2 &= F(-ax, bz, p) \\ P_3 &= f(-bz) \end{aligned}$$

and F and f are the bivariate and univariate standard normal cumulative distribution functions respectively. Put simply the P_i refer to the three possible outcomes; 1) stay and be promoted, 2) stay and don't be promoted, and 3) leave.

12. The Abraham and Farber analysis rests on the fact that tenure is biased only because of its correlation with the unobserved person/job/job match components. The authors representation of this relation is:

$$T = \beta D + e$$

where:

T = current tenure

D = completed length of tenure and is equal to:

$$D = \gamma M + v$$

where:

M = unobserved person/job/job match components

γ = unknown parameter

V = error term assumed to have an expected value of 0

Including an estimate of D in the analysis reduces the bias in the tenure (and other coefficients) due to the fact that it is correlated with the components of the unobserved heterogeneity as defined above. Abraham and Farber estimate D using a Weibull proportional hazards model. The proportional hazards model estimates the probability of separating from the firm conditional on tenure (time) and a vector of employee characteristics. In the current analysis I use the probability of separating from the firm estimated by a probit analysis and then construct the conditional probability of leaving the firm given that the employee was still with the firm at a certain point. This specification is dependent upon time since tenure was included as a regressor in the selection equation; in fact is a flexible form since the affect of tenure can be non-linear whereas in the Weibull model the affect of time is a linear function.

Finally, Abraham and Farber convert their separation probability into an estimate of expected tenure, whereas in this analysis the separation probability is used directly. If the Abraham and Farber hypothesis is correct, then the current modified procedure should also indicate whether or not the bias due to unobserved heterogeneity is a problem in this analysis.

13. Although not rigorous, the argument here is similar to the familiar censoring problem of duration models where the time at risk varies among individuals. In this case the time at risk for a promotion is not equal among employees and the statistical framework needs to be modified to incorporate this information.
14. Since the data did not contain a date of birth or a date of high school graduation, the EXP term was estimated as the period between the receipt of the highest degree and the time of hire. The interval between degrees was examined and if it was greater than two years for a masters, T-2 was added to the EXP term; if it was greater than five years for a doctorate T-5 was added to the EXP term. T represents the time period between the two degrees. If the highest degree was a doctorate and the individual had a masters, than

this check was made for the period between the bachelors and masters and the masters and the doctorate.

15. This variable can be thought of as the propensity to be married since it is ex-ante information in some instances.
16. The following discussion was clarified by conversations with Professor Michael Grossman.
17. This assumption is not consistent with human capital theory which would suggest a declining investment with age. It is also not consistent with a job matching hypothesis which would suggest that the employee would invest less with age because they would have had more time to find a good match and would therefore invest more in specific training.
18. See the Abraham and Medoff (1983) paper for details of this test.
19. The proportion of males among all engineering graduates was 98% in 1975 and 88% in 1984. (Statistical Abstract of the United States 1987.)
20. The magnitude of these variables are much greater than those reported for the general population (Hall 1983).
21. This partial affect was derived using the following formula:

$$(XB)B$$

where:

XB = the mean values of the right hand side variables multiplied by the coefficients

\hat{B} = the estimated coefficient

ϕ = the probability density function of a standard normal variable.

22. Only the results of table 3 are shown and discussed. The results obtained for tables 4 and 5 are identical to those of table 3.

APPENDIX A

TABLE A1
 PROMOTION RATES FOR WHITE MALE EMPLOYEES
 BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIENCE	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12			
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION
3	313.000	0.408	82.000	0.208	0.000	0.000	0.000	0.000	395.000	0.339
6	80.000	0.357	128.000	0.239	6.000	0.128	.	.	214.000	0.265
9	48.000	0.345	185.000	0.198	70.000	0.162	3.000	0.375	306.000	0.202
12	11.000	0.212	90.000	0.183	55.000	0.094	5.000	0.135	161.000	0.138
15	7.000	0.206	60.000	0.163	82.000	0.112	16.000	0.167	165.000	0.134
18	5.000	0.192	56.000	0.153	61.000	0.070	23.000	0.137	145.000	0.101
21	4.000	0.160	37.000	0.145	39.000	0.056	10.000	0.071	90.000	0.081
24	4.000	0.190	24.000	0.153	33.000	0.067	10.000	0.081	71.000	0.090
27	2.000	0.133	18.000	0.102	21.000	0.036	9.000	0.058	50.000	0.053
30	3.000	0.071	25.000	0.078	27.000	0.029	10.000	0.041	65.000	0.042
33	6.000	0.107	27.000	0.080	24.000	0.028	9.000	0.038	66.000	0.045
36	0.000	0.000	6.000	0.091	6.000	0.023	2.000	0.022	14.000	0.033
39	0.000	0.000	2.000	0.069	4.000	0.028	2.000	0.042	8.000	0.036
42	0.000	0.000	1.000	0.043	3.000	0.052	0.000	0.000	4.000	0.038
45	.	.	.	.	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	483.000	0.341	741.000	0.166	431.000	0.064	99.000	0.072	1754	0.126

TABLE A1
 PROMOTION RATES FOR WHITE MALE EMPLOYEES
 BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	62.000	0.408	8.000	0.080	0.000	0.000	0.000	0.000	70.000	0.261
3	356.000	0.397	197.000	0.218	7.000	0.075	1.000	0.143	561.000	0.295
6	28.000	0.280	129.000	0.228	34.000	0.146	1.000	0.143	192.000	0.212
9	14.000	0.200	150.000	0.171	86.000	0.120	6.000	0.176	256.000	0.151
12	6.000	0.214	71.000	0.201	58.000	0.088	10.000	0.120	145.000	0.129
15	3.000	0.107	57.000	0.162	77.000	0.087	18.000	0.135	155.000	0.111
18	2.000	0.125	41.000	0.131	62.000	0.070	24.000	0.135	129.000	0.093
21	2.000	0.105	25.000	0.152	24.000	0.045	9.000	0.062	60.000	0.069
24	3.000	0.273	8.000	0.088	16.000	0.039	4.000	0.033	31.000	0.049
27	4.000	0.182	17.000	0.087	24.000	0.033	12.000	0.061	57.000	0.050
30	2.000	0.033	29.000	0.070	35.000	0.032	10.000	0.036	76.000	0.041
33	1.000	0.077	9.000	0.091	5.000	0.016	3.000	0.021	18.000	0.032
36	0.000	0.000	0.000	0.000	3.000	0.037	0.000	0.000	3.000	0.024
39	.	.	0.000	0.000	0.000	0.000	1.000	0.063	1.000	0.024
42	.	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	483.000	0.341	741.000	0.166	431.000	0.064	99.000	0.072	1754	0.126

TABLE A1
 PROMOTION RATES FOR WHITE MALE EMPLOYEES
 BY YEARS IN GRADE AND SALARY GRADE LEVEL

YEARS IN GRADE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	82.000	0.168	128.000	0.120	60.000	0.050	18.000	0.061	288.000	0.094
2	357.000	0.502	323.000	0.189	162.000	0.089	41.000	0.096	883.000	0.189
4	18.000	0.340	134.000	0.213	62.000	0.059	18.000	0.075	232.000	0.117
6	6.000	0.136	32.000	0.149	51.000	0.076	8.000	0.062	97.000	0.092
8	12.000	0.240	51.000	0.185	37.000	0.055	8.000	0.064	108.000	0.096
10	1.000	0.100	21.000	0.148	14.000	0.039	5.000	0.083	41.000	0.072
12	3.000	0.143	18.000	0.155	15.000	0.046	1.000	0.023	37.000	0.073
14	0.000	0.000	15.000	0.150	8.000	0.038	0.000	0.000	23.000	0.066
16	3.000	0.214	9.000	0.114	6.000	0.032	0.000	0.000	18.000	0.060
18	1.000	0.200	5.000	0.091	12.000	0.129	0.000	0.000	18.000	0.114
20	0.000	0.000	4.000	0.080	2.000	0.040	0.000	0.000	6.000	0.055
22	0.000	0.000	1.000	0.083	1.000	0.024	0.000	0.000	2.000	0.034
26	.	.	.	.	1.000	1.000	.	.	1.000	1.000
TOTAL	483.000	0.341	741.000	0.166	431.000	0.064	99.000	0.072	1754	0.126

**TABLE A1
PROMOTION RATES FOR WHITE MALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL**

PERFORM- ANCE RATING	GRADE								TOTAL		
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		PROMOTIONS		
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	
1	1.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.059
2	8.000	0.060	2.000	0.005	2.000	0.004	2.000	0.029	14.000	0.012	
3	134.000	0.252	101.000	0.062	29.000	0.013	6.000	0.016	270.000	0.056	
4	229.000	0.402	374.000	0.215	200.000	0.071	38.000	0.059	841.000	0.146	
5	111.000	0.613	264.000	0.414	200.000	0.189	53.000	0.192	628.000	0.292	
TOTAL	483.000	0.341	741.000	0.166	431.000	0.064	99.000	0.072	1754	0.126	

TABLE A2
PROMOTION RATES FOR BLACK MALE EMPLOYEES
BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIENCE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION
3	12.000	0.279	0.000	0.000	.	.	.	.	12.000	0.194
6	4.000	0.125	5.000	0.167	0.000	0.000	.	.	9.000	0.138
9	3.000	0.111	8.000	0.148	0.000	0.000	.	.	11.000	0.121
12	1.000	0.063	5.000	0.143	0.000	0.000	1.000	1.000	7.000	0.103
15	1.000	0.111	4.000	0.118	1.000	0.071	0.000	0.000	6.000	0.102
18	1.000	0.100	3.000	0.188	1.000	0.111	0.000	0.000	5.000	0.132
21	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.500	1.000	0.043
24	0.000	0.000	0.000	0.000	1.000	0.167	0.000	0.000	1.000	0.063
27	0.000	0.000	.	.	0.000	0.000	0.000	0.000	0.000	0.000
30	.	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	.	.	0.000	0.000	0.000	0.000	.	.	0.000	0.000
36	.	.	0.000	0.000	0.000	0.000	.	.	0.000	0.000
45	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	22.000	0.151	25.000	0.121	3.000	0.042	2.000	0.167	52.000	0.119

TABLE A2
 PROMOTION RATES FOR BLACK MALE EMPLOYEES
 BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	2.000	0.286	0.000	0.000	0.000	0.000	.	.	2.000	0.111
3	15.000	0.221	7.000	0.130	0.000	0.000	.	.	22.000	0.157
6	3.000	0.107	5.000	0.161	1.000	0.091	.	.	9.000	0.129
9	1.000	0.045	7.000	0.123	1.000	0.091	0.000	0.000	9.000	0.099
12	1.000	0.100	3.000	0.200	0.000	0.000	1.000	1.000	5.000	0.143
15	0.000	0.000	3.000	0.088	1.000	0.059	1.000	0.167	5.000	0.076
18	.	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	.	.	.	.	.	.	0.000	0.000
24	.	.	.	.	.	.	0.000	0.000	0.000	0.000
27	0.000	0.000	.	.	.	.	.	.	0.000	0.000
30	.	.	0.000	0.000	.	.	.	.	0.000	0.000
TOTAL	22.000	0.151	25.000	0.121	3.000	0.042	2.000	0.167	52.000	0.119

TABLE A2
 PROMOTION RATES FOR BLACK MALE EMPLOYEES
 BY YEARS IN GRADE AND SALARY GRADE LEVEL

YEARS IN GRADE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	0.000	0.000	7.000	0.123	1.000	0.034	1.000	0.143	9.000	0.076
2	17.000	0.274	8.000	0.093	1.000	0.048	0.000	0.000	26.000	0.151
4	3.000	0.143	5.000	0.156	1.000	0.077	1.000	0.500	10.000	0.147
6	1.000	0.067	2.000	0.118	0.000	0.000	.	.	3.000	0.086
8	1.000	0.077	1.000	0.100	0.000	0.000	.	.	2.000	0.077
10	0.000	0.000	1.000	0.250	0.000	0.000	.	.	1.000	0.077
12	0.000	0.000	1.000	1.000	.	.	.	.	1.000	0.333
14	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	22.000	0.151	25.000	0.121	3.000	0.042	2.000	0.167	52.000	0.119

**TABLE A2
PROMOTION RATES FOR BLACK MALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL**

PERFORM- ANCE RATING	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
1	0.000	0.000	0.000	0.000	.	.	.	.	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	9.000	0.115	8.000	0.075	1.000	0.038	0.000	0.000	18.000	0.085
4	11.000	0.393	16.000	0.276	2.000	0.061	2.000	0.250	31.000	0.244
5	2.000	0.400	1.000	0.125	0.000	0.000	0.000	0.000	3.000	0.176
TOTAL	22.000	0.151	25.000	0.121	3.000	0.042	2.000	0.167	52.000	0.119

TABLE A3
 PROMOTION RATES FOR WHITE FEMALE EMPLOYEES
 BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIENCE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION	FREQUENCY	PROPORTION
3	92.000	0.379	12.000	0.194	0.000	0.000	.	.	104.000	0.340
6	42.000	0.378	27.000	0.273	2.000	0.250	0.000	0.000	71.000	0.323
9	18.000	0.340	14.000	0.144	2.000	0.105	1.000	0.333	35.000	0.203
12	5.000	0.192	9.000	0.176	6.000	0.200	.	.	20.000	0.187
15	2.000	0.250	10.000	0.263	2.000	0.133	0.000	0.000	14.000	0.226
18	3.000	0.250	2.000	0.111	1.000	0.100	1.000	0.500	7.000	0.167
21	1.000	0.167	2.000	0.182	0.000	0.000	0.000	0.000	3.000	0.130
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	1.000	0.167	2.000	0.182	0.000	0.000	.	.	3.000	0.150
30	0.000	0.000	2.000	0.154	0.000	0.000	1.000	0.500	3.000	0.130
33	1.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.045
36	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
39	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
42	.	.	0.000	0.000	0.000	0.000	.	.	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
TOTAL	165.000	0.338	80.000	0.187	13.000	0.111	3.000	0.231	261.000	0.250

TABLE A3
 PROMOTION RATES FOR WHITE FEMALE EMPLOYEES
 BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	21.000	0.350	3.000	0.167	1.000	0.500	.	.	25.000	0.313
3	120.000	0.373	28.000	0.196	2.000	0.133	0.000	0.000	150.000	0.311
6	15.000	0.357	27.000	0.243	3.000	0.143	0.000	0.000	45.000	0.254
9	4.000	0.167	10.000	0.156	1.000	0.038	1.000	0.500	16.000	0.138
12	3.000	0.300	2.000	0.118	6.000	0.429	.	.	11.000	0.268
15	0.000	0.000	6.000	0.250	0.000	0.000	1.000	0.500	7.000	0.156
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	1.000	0.167	0.000	0.000	.	.	1.000	0.111
24	0.000	0.000	0.000	0.000	.	.	.	.	0.000	0.000
27	1.000	0.333	2.000	0.200	0.000	0.000	1.000	0.500	4.000	0.182
30	1.000	0.200	1.000	0.077	0.000	0.000	.	.	2.000	0.083
33	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
36	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
39	.	.	0.000	0.000	.	.	.	.	0.000	0.000
45	.	.	.	.	0.000	0.000	.	.	0.000	0.000
TOTAL	165.000	0.338	80.000	0.187	13.000	0.111	3.000	0.231	261.000	0.250

**TABLE A3
PROMOTION RATES FOR WHITE FEMALE EMPLOYEES
BY YEARS IN GRADE AND SALARY GRADE LEVEL**

YEARS IN GRADE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	31.000	0.165	23.000	0.128	5.000	0.132	3.000	0.333	62.000	0.150
2	123.000	0.490	42.000	0.236	6.000	0.136	0.000	0.000	171.000	0.359
4	9.000	0.360	12.000	0.343	1.000	0.071	0.000	0.000	22.000	0.293
6	1.000	0.111	1.000	0.053	1.000	0.167	.	.	3.000	0.088
8	0.000	0.000	1.000	0.125	0.000	0.000	.	.	1.000	0.043
10	0.000	0.000	1.000	0.200	0.000	0.000	.	.	1.000	0.100
12	1.000	1.000	.	.	0.000	0.000	.	.	1.000	0.333
14	0.000	0.000	0.000	0.000	.	.	.	.	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
22	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	165.000	0.338	80.000	0.187	13.000	0.111	3.000	0.231	261.000	0.250

**TABLE A3
PROMOTION RATES FOR WHITE FEMALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL**

PERFORM- ANCE RATING	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12			
	PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS		PROMOTIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
2	3.000	0.079	0.000	0.000	0.000	0.000	.	.	3.000	0.040
3	38.000	0.196	8.000	0.057	2.000	0.047	1.000	0.333	49.000	0.129
4	93.000	0.465	41.000	0.230	6.000	0.133	2.000	0.250	142.000	0.329
5	31.000	0.554	31.000	0.397	5.000	0.227	0.000	0.000	67.000	0.424
TOTAL	165.000	0.338	80.000	0.187	13.000	0.111	3.000	0.231	261.000	0.250

TABLE A4
SEPERATION RATES FOR WHITE MALE EMPLOYEES
BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIENCE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
3	69.000	0.082	10.000	0.025	0.000	0.000	0.000	0.000	79.000	0.064
6	7.000	0.030	19.000	0.034	1.000	0.021	.	.	27.000	0.032
9	8.000	0.054	16.000	0.017	2.000	0.005	2.000	0.200	28.000	0.018
12	2.000	0.037	16.000	0.031	5.000	0.008	3.000	0.075	26.000	0.022
15	1.000	0.029	10.000	0.027	9.000	0.012	2.000	0.020	22.000	0.018
18	3.000	0.103	7.000	0.019	6.000	0.007	3.000	0.018	19.000	0.013
21	2.000	0.074	6.000	0.023	8.000	0.011	4.000	0.028	20.000	0.018
24	0.000	0.000	5.000	0.031	7.000	0.014	3.000	0.024	15.000	0.019
27	1.000	0.063	5.000	0.027	9.000	0.015	3.000	0.019	18.000	0.019
30	7.000	0.143	24.000	0.070	52.000	0.052	10.000	0.039	93.000	0.057
33	18.000	0.243	96.000	0.221	138.000	0.141	23.000	0.089	275.000	0.157
36	3.000	0.273	14.000	0.175	105.000	0.289	19.000	0.173	141.000	0.250
39	4.000	0.444	27.000	0.482	137.000	0.489	32.000	0.400	200.000	0.471
42	3.000	0.600	37.000	0.617	101.000	0.635	35.000	0.614	176.000	0.626
45	.	.	7.000	1.000	15.000	0.789	7.000	0.875	29.000	0.853
TOTAL	128.000	0.083	299.000	0.063	595.000	0.082	146.000	0.096	1168	0.077

TABLE A4
SEPERATION RATES FOR WHITE MALE EMPLOYEES
BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	19.000	0.111	2.000	0.020	0.000	0.000	1.000	0.200	22.000	0.076
3	67.000	0.070	36.000	0.038	3.000	0.031	0.000	0.000	106.000	0.053
6	2.000	0.020	18.000	0.031	3.000	0.013	0.000	0.000	23.000	0.025
9	1.000	0.014	18.000	0.020	5.000	0.007	2.000	0.056	26.000	0.015
12	0.000	0.000	3.000	0.008	8.000	0.012	4.000	0.046	15.000	0.013
15	4.000	0.125	8.000	0.022	11.000	0.012	3.000	0.022	26.000	0.018
18	0.000	0.000	10.000	0.031	8.000	0.009	5.000	0.027	23.000	0.016
21	1.000	0.050	7.000	0.041	12.000	0.022	4.000	0.027	24.000	0.027
24	1.000	0.083	4.000	0.042	10.000	0.024	1.000	0.008	16.000	0.025
27	3.000	0.120	14.000	0.067	48.000	0.062	6.000	0.030	71.000	0.059
30	16.000	0.211	89.000	0.178	185.000	0.145	34.000	0.108	324.000	0.149
33	10.000	0.435	40.000	0.288	116.000	0.270	27.000	0.162	193.000	0.254
36	1.000	0.333	19.000	0.500	93.000	0.538	22.000	0.468	135.000	0.517
39	2.000	1.000	10.000	0.769	47.000	0.671	15.000	0.484	74.000	0.638
42	1.000	1.000	21.000	0.724	45.000	0.682	22.000	0.815	89.000	0.724
45	.	.	.	.	1.000	1.000	.	.	1.000	1.000
TOTAL	128.000	0.083	299.000	0.063	595.000	0.082	146.000	0.096	1168	0.077

TABLE A4
SEPERATION RATES FOR WHITE MALE EMPLOYEES
BY YEARS IN GRADE AND SALARY GRADE LEVEL

YEARS IN GRADE	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12			
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	29.000	0.056	58.000	0.051	86.000	0.067	16.000	0.051	189.000	0.058
2	73.000	0.093	83.000	0.046	72.000	0.038	22.000	0.049	250.000	0.051
4	5.000	0.086	27.000	0.041	93.000	0.081	25.000	0.094	150.000	0.070
6	5.000	0.102	17.000	0.073	61.000	0.083	19.000	0.128	102.000	0.088
8	5.000	0.091	28.000	0.092	51.000	0.071	20.000	0.138	104.000	0.085
10	0.000	0.000	13.000	0.084	46.000	0.115	14.000	0.189	73.000	0.114
12	2.000	0.087	15.000	0.115	41.000	0.112	13.000	0.232	71.000	0.123
14	4.000	0.200	13.000	0.115	30.000	0.124	4.000	0.154	51.000	0.127
16	2.000	0.125	10.000	0.112	43.000	0.187	9.000	0.321	64.000	0.176
18	0.000	0.000	16.000	0.225	30.000	0.244	2.000	0.286	48.000	0.233
20	3.000	0.500	16.000	0.242	27.000	0.351	1.000	0.143	47.000	0.301
22	0.000	0.000	3.000	0.200	14.000	0.250	1.000	0.333	18.000	0.237
26	.	.	.	.	0.000	0.000	.	.	0.000	0.000
28	.	.	.	.	1.000	1.000	.	.	1.000	1.000
TOTAL	128.000	0.083	299.000	0.063	595.000	0.082	146.000	0.096	1168	0.077

TABLE A4
SEPERATION RATES FOR WHITE MALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL

PERFORM- ANCE RATING	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		SEPERATIONS	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
1	4.000	0.667	4.000	0.333	7.000	0.583	3.000	0.600	18.000	0.514
2	40.000	0.231	105.000	0.194	192.000	0.253	27.000	0.281	364.000	0.232
3	40.000	0.070	116.000	0.066	252.000	0.101	65.000	0.147	473.000	0.090
4	38.000	0.063	53.000	0.030	119.000	0.041	39.000	0.057	249.000	0.041
5	6.000	0.032	21.000	0.032	25.000	0.023	12.000	0.042	64.000	0.029
TOTAL	128.000	0.083	299.000	0.063	595.000	0.082	146.000	0.096	1168	0.077

TABLE A5
SEPERATION RATES FOR BLACK MALE EMPLOYEES
BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIE- NCE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
3	9.000	0.173	2.000	0.095	.	.	.	.	11.000	0.151
6	3.000	0.086	2.000	0.063	0.000	0.000	.	.	5.000	0.071
9	1.000	0.036	3.000	0.053	0.000	0.000	.	.	4.000	0.042
12	1.000	0.059	1.000	0.028	1.000	0.059	0.000	0.000	3.000	0.042
15	0.000	0.000	1.000	0.029	0.000	0.000	0.000	0.000	1.000	0.017
18	0.000	0.000	0.000	0.000	1.000	0.100	0.000	0.000	1.000	0.026
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	1.000	1.000	0.000	0.000	0.000	0.000	1.000	0.250
30	.	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	.	.	1.000	0.333	0.000	0.000	.	.	1.000	0.250
36	.	.	0.000	0.000	0.000	0.000	.	.	0.000	0.000
45	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	14.000	0.087	11.000	0.050	2.000	0.027	0.000	0.000	27.000	0.058

TABLE A5
SEPERATION RATES FOR BLACK MALE EMPLOYEES
BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	1.000	0.125	1.000	0.091	0.000	0.000	.	.	2.000	0.100
3	11.000	0.139	4.000	0.069	1.000	0.053	.	.	16.000	0.103
6	1.000	0.034	4.000	0.114	0.000	0.000	.	.	5.000	0.067
9	1.000	0.043	1.000	0.017	0.000	0.000	0.000	0.000	2.000	0.022
12	0.000	0.000	0.000	0.000	1.000	0.100	0.000	0.000	1.000	0.028
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	.	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	.	.	.	.	.	.	0.000	0.000
24	.	.	.	.	.	.	0.000	0.000	0.000	0.000
27	0.000	0.000	1.000	1.000	.	.	.	.	1.000	0.500
30	.	.	0.000	0.000	.	.	.	.	0.000	0.000
TOTAL	14.000	0.087	11.000	0.050	2.000	0.027	0.000	0.000	27.000	0.058

TABLE A5
SEPERATION RATES FOR BLACK MALE EMPLOYEES
BY YEARS IN GRADE AND SALARY GRADE LEVEL

YEARS IN GRADE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	4.000	0.138	1.000	0.017	0.000	0.000	0.000	0.000	5.000	0.041
2	6.000	0.088	7.000	0.075	1.000	0.045	0.000	0.000	14.000	0.075
4	2.000	0.087	2.000	0.059	1.000	0.071	0.000	0.000	5.000	0.068
6	1.000	0.063	1.000	0.056	0.000	0.000	.	.	2.000	0.054
8	1.000	0.071	0.000	0.000	0.000	0.000	.	.	1.000	0.037
10	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
12	0.000	0.000	0.000	0.000	.	.	.	.	0.000	0.000
14	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	14.000	0.087	11.000	0.050	2.000	0.027	0.000	0.000	27.000	0.058

TABLE A5
SEPERATION RATES FOR BLACK MALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL

PERFORM- ANCE RATING	GRADE								TOTAL	
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12			
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
1	5.000	0.833	2.000	0.667	.	.	.	.	7.000	0.778
2	3.000	0.081	5.000	0.128	0.000	0.000	0.000	0.000	8.000	0.093
3	5.000	0.060	4.000	0.036	2.000	0.071	0.000	0.000	11.000	0.049
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	1.000	0.167	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.056
TOTAL	14.000	0.087	11.000	0.050	2.000	0.027	0.000	0.000	27.000	0.058

TABLE A6
SEPERATION RATES FOR WHITE FEMALE EMPLOYEES
BY YEARS OF EXPERIENCE AND SALARY GRADE LEVEL

YEARS OF EXPERIE- NCE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
3	30.000	0.110	10.000	0.139	0.000	0.000	.	.	40.000	0.116
6	14.000	0.112	3.000	0.029	0.000	0.000	0.000	0.000	17.000	0.072
9	8.000	0.131	6.000	0.058	0.000	0.000	0.000	0.000	14.000	0.075
12	1.000	0.037	6.000	0.105	0.000	0.000	.	.	7.000	0.061
15	3.000	0.273	3.000	0.073	0.000	0.000	0.000	0.000	6.000	0.088
18	1.000	0.077	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.023
21	0.000	0.000	0.000	0.000	1.000	0.167	0.000	0.000	1.000	0.042
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	0.048
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	1.000	0.167	1.000	0.125	0.000	0.000	0.000	0.000	2.000	0.083
36	1.000	0.167	2.000	0.222	1.000	0.167	.	.	4.000	0.190
39	3.000	0.333	4.000	0.500	0.000	0.000	.	.	7.000	0.389
42	1.000	1.000	3.000	0.600	1.000	0.333	.	.	5.000	0.556
45	0.000	0.000	1.000	0.500	0.000	0.000	.	.	1.000	0.250
TOTAL	63.000	0.114	39.000	0.084	3.000	0.025	1.000	0.071	106.000	0.092

TABLE A6
SEPERATION RATES FOR WHITE FEMALE EMPLOYEES
BY YEARS IN COMPANY AND SALARY GRADE LEVEL

YEARS IN COMPANY	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	8.000	0.118	2.000	0.100	0.000	0.000	.	.	10.000	0.111
3	44.000	0.120	13.000	0.083	0.000	0.000	0.000	0.000	57.000	0.106
6	3.000	0.067	7.000	0.059	0.000	0.000	0.000	0.000	10.000	0.053
9	1.000	0.040	3.000	0.045	0.000	0.000	0.000	0.000	4.000	0.033
12	0.000	0.000	2.000	0.105	0.000	0.000	.	.	2.000	0.047
15	1.000	0.083	1.000	0.040	1.000	0.111	0.000	0.000	3.000	0.063
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
24	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	2.000	0.200
27	1.000	0.250	1.000	0.091	0.000	0.000	0.000	0.000	2.000	0.083
30	0.000	0.000	2.000	0.133	0.000	0.000	.	.	2.000	0.077
33	0.000	0.000	0.000	0.000	0.000	0.000	.	.	0.000	0.000
36	1.000	0.500	1.000	0.250	0.000	0.000	.	.	2.000	0.167
39	3.000	1.000	5.000	0.714	.	.	.	.	8.000	0.800
42	1.000	1.000	2.000	1.000	1.000	1.000	.	.	4.000	1.000
45	.	.	.	.	0.000	0.000	.	.	0.000	0.000
TOTAL	63.000	0.114	39.000	0.084	3.000	0.025	1.000	0.071	106.000	0.092

TABLE A6
SEPERATION RATES FOR WHITE FEMALE EMPLOYEES
BY YEARS IN GRADE AND SALARY GRADE LEVEL

YEARS IN GRADE	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
0	24.000	0.113	11.000	0.058	0.000	0.000	0.000	0.000	35.000	0.078
2	32.000	0.113	13.000	0.068	1.000	0.022	1.000	0.250	47.000	0.090
4	4.000	0.138	7.000	0.167	0.000	0.000	0.000	0.000	11.000	0.128
6	0.000	0.000	1.000	0.050	0.000	0.000	.	.	1.000	0.029
8	1.000	0.125	3.000	0.273	1.000	0.111	.	.	5.000	0.179
10	0.000	0.000	2.000	0.286	0.000	0.000	.	.	2.000	0.167
12	0.000	0.000	.	.	0.000	0.000	.	.	0.000	0.000
14	1.000	0.333	2.000	0.667	.	.	.	.	3.000	0.500
16	0.000	0.000	0.000	0.000	1.000	0.500	.	.	1.000	0.143
20	1.000	1.000	.	.	.	.	.	.	1.000	1.000
22	0.000	0.000	.	.	.	.	.	.	0.000	0.000
TOTAL	63.000	0.114	39.000	0.084	3.000	0.025	1.000	0.071	106.000	0.092

TABLE A6
SEPERATION RATES FOR WHITE FEMALE EMPLOYEES
BY PERFORMANCE RATING AND SALARY GRADE LEVEL

PERFORM- ANCE RATING	GRADE									
	GRADE 1-3		GRADE 4-6		GRADE 7-9		GRADE 10-12		TOTAL	
	SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS		SEPERATIONS	
	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION	FREQUE- NCY	PROPOR- TION
2	9.000	0.191	2.000	0.063	1.000	0.125	1.000	1.000	13.000	0.148
3	27.000	0.122	17.000	0.108	2.000	0.044	0.000	0.000	46.000	0.108
4	17.000	0.078	14.000	0.073	0.000	0.000	0.000	0.000	31.000	0.067
5	10.000	0.152	6.000	0.071	0.000	0.000	0.000	0.000	16.000	0.092
TOTAL	63.000	0.114	39.000	0.084	3.000	0.025	1.000	0.071	106.000	0.092

APPENDIX B

APPENDIX B1
ESTIMATES OF SELECTION EQUATION-PROBABILITY OF STAYING WITH FIRM(SEPARATIONS)

WHITE MALES

Log-Likelihood.... -2901.0
 Restricted Log-L... -4111.2
 Chi-Squared..... 2420.4
 Degrees of Freedom.. 22
 Significance Level. 0.32E-13

BLACK MALES

Log-likelihood..... -71.5
 Restricted Log-L.... -102.9
 Chi-Squared..... 62.9
 Degrees of Freedom.. 22
 Significance Level.. 0.02E-05

FEMALES

Log-Likelihood..... -315.3
 Restricted Log-L.... -353.8
 Chi-Squared..... 76.9
 Degrees of Freedom.. 22
 Significance Level.. 0.25E-08

Variable	Coeff	T-ratio (Sig)
ONE	0.361	2.770 (0.005)
EXP	0.637E-01	4.957 (0.000)
EXPSQ	-0.231E-02	-9.364 (0.000)
TENURE	0.694E-01	5.503 (0.000)
TENSQ	-0.202E-02	-7.566 (0.000)
SERVGD	0.190E-02	0.449 (0.653)
SERVGDSQ	-0.149E-03	-0.805 (0.420)
MA	-0.126	-2.447 (0.014)
PHD	-0.150	-2.369 (0.017)
WDEG	0.337	5.042 (0.000)
PRATE	0.260	11.513 (0.000)
MAR	0.154	2.667 (0.007)
NCHIL18	0.628E-01	2.675 (0.007)
SALB1	-0.140E-03	-2.770 (0.005)
MKT	-0.142	-2.645 (0.008)
RES	0.117	1.724 (0.084)
MAN	0.156	2.938 (0.003)
PER	0.605E-01	0.604 (0.545)
APC	-0.150	-2.039 (0.041)
MISS	0.134	1.633 (0.102)
GRAD46	0.173	2.402 (0.016)
GRAD79	0.389	3.950 (0.000)
GRAD1012	0.611	3.930 (0.000)

Variable	Coefficient	T-ratio (Sig)
ONE	-2.90	-2.409 (0.016)
EXP	0.102	1.308 (0.190)
EXPSQ	-0.211E-02	-0.966 (0.334)
TENURE	0.169	1.778 (0.075)
TENSQ	-0.799E-02	-2.063 (0.039)
SERVGD	-0.369	-1.584 (0.113)
SERVGDSQ	0.430E-01	1.563 (0.118)
MA	-0.264	-0.805 (0.420)
PHD	-0.485	-0.930 (0.352)
WDEG	0.262	0.514 (0.607)
PRATE	0.748	4.467 (0.000)
MAR	0.472	1.765 (0.077)
NCHIL18	0.725E-01	0.548 (0.583)
SALB1	0.817E-03	1.346 (0.178)
MKT	-0.455	-1.314 (0.188)
RES	0.591	0.988 (0.322)
MAN	0.468E-01	0.137 (0.890)
PER	-0.813	-1.664 (0.096)
APC	0.134	0.212 (0.831)
MISS	2.19	0.006 (0.994)
GRAD46	-0.470	-1.268 (0.204)
GRAD79	-1.34	-1.471 (0.141)
GRAD1012	1.64	0.008 (0.993)

Variable	Coeff	T-ratio (Sig)
ONE	1.04	2.094 (0.036)
EXP	0.138E-01	0.450 (0.652)
EXPSQ	-0.322E-03	-0.402 (0.687)
TENURE	0.121	3.263 (0.001)
TENSQ	-0.353E-02	-3.795 (0.000)
SERVGD	-0.130	-2.397 (0.016)
SERVGDSQ	0.449E-02	1.411 (0.158)
MA	-0.177E-02	-0.012 (0.990)
PHD	0.667	1.871 (0.061)
WDEG	0.141	0.587 (0.557)
PRATE	0.502E-01	0.726 (0.467)
MAR	0.173	1.500 (0.133)
NCHIL18	-0.283E-01	-0.269 (0.788)
SALB1	-0.179E-03	-0.717 (0.473)
MKT	0.124	0.729 (0.466)
RES	0.206	1.008 (0.313)
MAN	-0.242E-01	-0.146 (0.883)
PER	0.234	0.795 (0.426)
APC	0.239E-01	0.124 (0.901)
MISS	0.155	0.194 (0.845)
GRAD46	0.547E-01	0.336 (0.737)
GRAD79	1.02	2.277 (0.022)
GRAD1012	-0.134	-0.190 (0.849)

APPENDIX B1
SELECTION EQUATION ESTIMATES
MAXIMUM LIKELIHOOD ESTIMATION OF PROBABILITY OF STAYING IN FIRM

WHITE MALES

Log-Likelihood..... -7088.4

Variable	Coeff	T-ratio (Sig)
ONE	0.357	2.786 (0.005)
EXP	0.635E-01	4.873 (0.000)
EXPSQ	-0.231E-02	-9.263 (0.000)
TENURE	0.695E-01	5.638 (0.000)
TENSQ	-0.202E-02	-7.761 (0.000)
SERVGD	0.213E-02	0.501 (0.616)
SERVGD8Q	-0.152E-03	-0.845 (0.397)
MA	-0.128	-2.448 (0.014)
PHD	-0.149	-2.342 (0.019)
WDEB	0.337	5.287 (0.000)
PRATE	0.260	12.293 (0.000)
MAR	0.152	2.562 (0.010)
NCHIL18	0.619E-01	2.680 (0.007)
SALB1	-0.139E-03	-2.834 (0.004)
MKT	-0.140	-2.586 (0.009)
RES	0.115	1.657 (0.097)
MAN	0.155	2.900 (0.003)
PER	0.649E-01	0.656 (0.511)
APC	-0.148	-1.915 (0.055)
MISS	0.134	1.625 (0.104)
GRAD46	0.176	2.388 (0.016)
GRAD79	0.391	3.941 (0.000)
GRAD1012	0.611	4.061 (0.000)
RHO(1,2)	0.168	0.315 (0.752)

WHITE FEMALES

Log-Likelihood..... - 778.5

Variable	Coeff	T-ratio (Sig)
ONE	1.13	2.152 (0.031)
EXP	0.162E-01	0.474 (0.635)
EXPSQ	-0.401E-03	-0.379 (0.704)
TENURE	0.126	2.945 (0.003)
TENSQ	-0.360E-02	-3.335 (0.000)
SERVGD	-0.134	-2.194 (0.028)
SERVGD8Q	0.472E-02	1.352 (0.176)
MA	-0.176E-02	-0.010 (0.991)
PHD	0.656	1.636 (0.101)
WDEB	0.161	0.570 (0.568)
PRATE	0.510E-01	0.708 (0.479)
MAR	0.131	1.066 (0.286)
NCHIL18	0.401E-01	0.415 (0.678)
SALB1	-0.232E-03	-0.933 (0.350)
MKT	0.111	0.607 (0.543)
RES	0.173	0.761 (0.446)
MAN	-0.440E-01	-0.264 (0.791)
PER	0.228	0.703 (0.481)
APC	-0.155E-01	-0.076 (0.939)
MISS	0.260	0.203 (0.838)
GRAD46	0.767E-01	0.457 (0.647)
GRAD79	1.09	2.490 (0.012)
GRAD1012	0.184	0.257 (0.797)
RHO(1,2)	0.989	0.741 (0.458)

APPENDIX B2
REDUCED FORM ESTIMATES OF THE PROBABILITY OF STAYING IN FIRM (SEPARATIONS)

WHITE MALES

Log-Likelihood..... -2896.2
Restricted Log-L... -4111.2
Chi-Squared..... 2430.0
Degrees of Freedom. 27
Significance Level. 0.32E-13

BLACK MALES

Log-Likelihood..... -69.9
Restricted Log-L..... -102.9
Chi-Squared..... 66.1
Degrees of Freedom... 27
Significance Level.. 0.394E-04

FEMALES

Log-Likelihood.... -312.2
Restricted Log-L... -353.8
Chi-Squared..... 83.1
Degrees of Freedom.. 27
Significance Level. 0.999E-08

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Variable	Coeff	T-ratio (Sig)
ONE	0.271	1.778 (0.075)
EXP	0.662E-01	5.047 (0.000)
EXPSQ	-0.235E-02	-9.418 (0.000)
TENURE	0.688E-01	5.423 (0.000)
TENSQ	-0.202E-02	-7.534 (0.000)
SERVGD	0.179E-02	0.420 (0.674)
SERVGDSD	-0.157E-03	-0.847 (0.397)
MA	-0.122	-2.332 (0.019)
PHD	-0.183	-2.535 (0.011)
WDEB	0.346	5.134 (0.000)
MAR	0.153	2.650 (0.008)
NCHIL18	0.647E-01	2.747 (0.006)
SALB1	-0.147E-03	-2.872 (0.004)
FRATE	0.262	11.580 (0.000)
MKT	-0.147	-2.607 (0.009)
RES	0.840E-01	1.191 (0.233)
MAN	0.136	2.509 (0.012)
PER	0.719E-01	0.705 (0.480)
APC	-0.105	-1.342 (0.179)
MISS	0.129	1.558 (0.119)
GRAD46	0.171	2.372 (0.017)
GRAD79	0.383	3.857 (0.000)
GRAD1012	0.622	3.992 (0.000)
ENG	0.104	1.201 (0.229)
SCI	0.169	1.872 (0.061)
COM	0.355	1.301 (0.193)
LAW	-0.878E-01	-0.429 (0.667)
BUS	0.115E-01	0.125 (0.900)

Variable	Coeff	T-ratio (Sig)
ONE	-2.71	-2.149 (0.031)
EXP	0.727E-01	0.845 (0.398)
EXPSQ	-0.137E-02	-0.564 (0.572)
TENURE	0.171	1.767 (0.077)
TENSQ	-0.800E-02	-2.003 (0.045)
SERVGD	-0.362	-1.519 (0.128)
SERVGDSD	0.426E-01	1.501 (0.133)
MA	-0.234	-0.691 (0.489)
PHD	-0.411	-0.625 (0.531)
WDEB	0.263	0.503 (0.615)
MAR	0.471	1.704 (0.089)
NCHIL18	0.063E-01	0.635 (0.525)
SALB1	0.939E-03	1.453 (0.146)
FRATE	0.749	4.429 (0.000)
MKT	-0.423	-1.111 (0.266)
RES	0.540	0.866 (0.386)
MAN	0.581E-01	0.164 (0.869)
PER	-0.833	-1.600 (0.109)
APC	0.300	0.441 (0.659)
MISS	2.40	0.007 (0.994)
GRAD46	-0.430	-1.156 (0.247)
GRAD79	-1.36	-1.489 (0.136)
GRAD1012	1.11	0.006 (0.995)
ENG	-0.420	-0.783 (0.433)
SCI	-0.337	-0.603 (0.494)
COM	4.15	0.022 (0.982)
LAW	-0.836	-0.829 (0.406)
BUS	-0.534	-1.101 (0.270)

Variable	Coeff	T-ratio (Sig)
ONE	0.878	1.731 (0.083)
EXP	0.278E-01	0.842 (0.397)
EXPSQ	-0.535E-03	-0.638 (0.523)
TENURE	0.129	3.361 (0.000)
TENSQ	-0.370E-02	-3.881 (0.000)
SERVGD	-0.135	-2.469 (0.013)
SERVGDSD	0.447E-02	1.381 (0.167)
MA	0.488E-01	0.311 (0.755)
PHD	0.855	2.180 (0.029)
WDEB	0.900E-01	0.370 (0.711)
MAR	0.160	1.380 (0.167)
NCHIL18	-0.339E-01	-0.325 (0.745)
SALB1	-0.286E-03	-1.087 (0.277)
FRATE	0.584E-01	0.037 (0.402)
MKT	0.125	0.726 (0.467)
RES	0.135	0.634 (0.526)
MAN	-0.713E-01	-0.384 (0.700)
PER	0.274	0.903 (0.366)
APC	-0.550E-01	-0.253 (0.800)
MISS	0.863E-02	0.011 (0.991)
GRAD46	0.153E-01	0.093 (0.925)
GRAD79	0.982	2.188 (0.028)
GRAD1012	0.148	0.186 (0.852)
ENG	0.366	1.556 (0.119)
SCI	0.335	1.918 (0.055)
COM	0.305	1.214 (0.224)
LAW	-0.501	-0.688 (0.491)
BUS	0.410	1.949 (0.051)

APPENDIX B3
 REDUCED FORM ESTIMATES OF PROBABILITY OF STAYING IN FIRM(SEPARATIONS)
 MAXIMUM LIKELIHOOD CORRECTION FOR ATTRITION BIAS

WHITE MALES

BLACK MALES *

FEMALES

Log-Likelihood..... -7083.2

Log-Likelihood..... -772.24

Variable Coeff T-ratio (Sig)

Variable	Coeff	T-ratio (Sig)
ONE	0.266	1.798 (0.072)
EXP	0.658E-01	4.981 (0.000)
EXPSQ	-0.235E-02	-9.323 (0.000)
TENURE	0.690E-01	5.576 (0.000)
TENSQ	-0.203E-02	-7.737 (0.000)
SERVGD	0.201E-02	0.471 (0.637)
SERVGD SQ	-0.159E-03	-0.887 (0.375)
MA	-0.123	-2.319 (0.020)
PHD	-0.180	-2.457 (0.014)
WDEG	0.345	5.330 (0.000)
MAR	0.152	2.554 (0.010)
NCHIL18	0.646E-01	2.766 (0.005)
SALB1	-0.146E-03	-2.904 (0.003)
PRATE	0.263	12.287 (0.000)
MKT	-0.146	-2.528 (0.011)
RES	0.815E-01	1.120 (0.262)
MAN	0.135	2.458 (0.013)
PER	0.750E-01	0.733 (0.463)
APC	-0.105	-1.262 (0.207)
MISS	0.128	1.520 (0.128)
GRAD46	0.174	2.366 (0.017)
GRAD79	0.385	3.853 (0.000)
GRAD1012	0.623	4.093 (0.000)
ENG	0.106	1.273 (0.202)
SCI	0.170	1.968 (0.049)
COM	0.359	1.324 (0.185)
LAW	-0.890E-01	-0.466 (0.641)
BUS	0.147E-01	0.166 (0.868)
RHO(1,2)	0.152	0.285 (0.775)

Variable Coeff T-ratio (Sig)

Variable	Coeff	T-ratio (Sig)
ONE	1.03	1.866 (0.062)
EXP	0.330E-01	0.857 (0.391)
EXPSQ	-0.673E-03	-0.590 (0.555)
TENURE	0.133	2.974 (0.002)
TENSQ	-0.375E-02	-3.296 (0.000)
SERVGD	-0.134	-2.122 (0.033)
SERVGD SQ	0.437E-02	1.181 (0.237)
MA	0.394E-01	0.217 (0.828)
PHD	0.885	2.096 (0.036)
WDEB	0.136	0.466 (0.640)
MAR	0.142	1.087 (0.277)
NCHIL18	0.734E-02	0.070 (0.944)
SALB1	-0.378E-03	-1.388 (0.165)
PRATE	0.601E-01	0.796 (0.426)
MKT	0.109	0.581 (0.561)
RES	0.111	0.470 (0.638)
MAN	-0.839E-01	-0.420 (0.674)
PER	0.275	0.772 (0.440)
APC	-0.908E-01	-0.413 (0.679)
MISS	0.343E-01	0.025 (0.979)
GRAD46	0.536E-01	0.305 (0.760)
GRAD79	1.11	2.465 (0.013)
GRAD1012	0.441	0.266 (0.790)
ENG	0.340	1.254 (0.209)
SCI	0.295	1.447 (0.147)
COM	0.272	1.013 (0.311)
LAW	-0.614	-0.389 (0.697)
BUS	0.379	1.677 (0.093)

* The computer program(LIMDEP) would not converge after several attempts using a variety of algorithms and starting values.

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