PROMOTIONS, STATE DEPENDENCE AND INTRAFIRM JOB MOBILITY: EVIDENCE FROM PERSONNEL RECORDS*

Pablo Acosta+

University of Illinois at Urbana-Champaign

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Abstract

The objective of this paper is to add evidence of job mobility within a firm using personnel records from a single large U.S. corporation, focusing on the determinants of the hazard rates of being promoted to a higher hierarchy level. How to successfully control for unobserved heterogeneity is the goal in this type of analyses, and the approach taken here is to look at the history of the worker, by recognizing state dependence on past promotions. The results show that: (a) the peak of the promotion hazard rates is registered at exactly one year at the current position, even after controlling for observables characteristics and state dependence; (b) males, whites, and more educated workers have a higher probability of being promoted; (c) there is no evidence of "fast tracks": previous promotions do not imply a higher probability of future promotion, even after controlling for tenure at the current job; and (d) recent new hires seems to have an advantage when competing with insiders for a higher position. These last two findings seem to be at odds with the hypotheses of "job-specific" and "firm-specific" human capital, and to indirectly agree with the "Peter Principle" prediction (Lazear, 2004), which suggests that if workers make efforts beyond their capabilities in order to be promoted, after reaching the desired higher position their incentives to be "over-productive" may decline.

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+ Department of Economics, University of Illinois at Urbana-Champaign. 1206 S. Sixth Street, Champaign, Illinois 61820, USA. E-mail: pacosta@uiuc.edu.

1. Introduction

The objective of this paper is to present evidence of job mobility within a firm, in particular by focusing on the determinants of the hazard rates of being promoted to a higher hierarchy or superior level. Promotions are often seen as the prize of a tournament in which several co-workers compete for a limited number of slots (Lazear and Rosen, 1981). The assignment to the job is usually based on relative rather than absolute performance: the individual who gets the promotion is the best, but this does not imply that his competitors are not suitable for the position. In most of the cases, promotion to a higher hierarchy position is also associated with higher wages (McCue, 1996), although this is not always true: in some cases, a promotion is simply a way a firm has to recognize the effort of the employees without necessarily implying raises in compensations. But, in general, promotions should be seen as a link between compensation and performances. Lazear (1992) found that individuals who change jobs within a firm are the ones who experience larger growth in wages. Finally, as pointed out by Baker, Jensen and Murphy (1988), in the last decades firms have made an "overwhelming use of promotion-based compensation schemes". Several theoretical papers have been written on how employers decide promotions in a firm (Jovanovic, 1979; Carmichael, 1983; Milgrom, 1988; Bernhardt and Scoones, 1993; Prendergast 1993; Bernhardt, 1995; Gibbs, 1995; Prendergast and Topel, 1996; Chiappori, Salanie and Valentin, 1999; Gibbons and Waldman, 1999; Fairburn and Malcomson, 2001; Lazear, 2004), however little evidence on how people differ in their probability of "climbing the corporate ladder" in a firm has been presented up to date.

The paper shows empirical results on the determinants of the probability of being promoted. In order to do so, it is necessary to control not only for observable demographic characteristics of the employee, such as age, gender, education and tenure, but also unobserved heterogeneity should matter. In particular, some workers are naturally more talented, productive, sociable or different to the eyes of their employers than other co-workers, conditional on the same observed

characteristics. A major difficulty arises in that worker's performance, sometimes observed by the employer, is not usually available to the econometrician. Although even in exceptional cases performance ratings can be obtained from personnel records, these are usually not fully objective and most of the time they rely on supervisors' opinions that do not necessarily reflect the true productivity of the worker.

Hence, how to successfully control for unobserved heterogeneity is the goal in this type of analyses, and in this paper the approach will be to focus on the history of the worker, in particular by distinguishing between those with previous promotions from the rest, and between insiders and new hires; in other words, recognizing state dependence. This approach to control for unmeasured quality of the worker by looking at her history at the firm was originally addressed in Chiappori, Salanie and Valentin (1999), who proposed this dynamic setting for promotions and wages in order to overcome the lack of performance proxies[1]. In fact, Farber (1994) distinguishes between "fixed heterogeneity" and "state dependence" as the main components of individual heterogeneity: the former corresponds to the set of unmeasured variables that influence current outcome (a promotion) but are themselves not influenced by past outcomes, while the latter refers to the effect that past outcomes (previous promotions) might have on the current outcome. In this paper, only the last component is addressed.

It is natural to think that a worker who has been promoted in the past should have a different probability of being promoted again than those who have been recently hired or were not promoted before. However, the sign of the difference is "a priori" unpredictable. If promotions only reflect higher productivity or superior ability of certain workers, it is reasonable to expect that workers with previous promotions should be more likely to be promoted again. On the other hand, as pointed out by Fairburn and Malcomson (2001) and Lazear (2004), if workers make efforts beyond their

[1] The method proposed in Chiappori, Salanie and Valentin (1999), instead of focusing attention on the way wages at date t depend on performance at the same period, looks at the way wages at t depends on wages at t-1 and before. For this approach, data on individual outcomes are no longer necessary.

capabilities in order to be promoted, after reaching the desired higher position their incentives to be "over-productive" may be reduced. This theoretical prediction is known in the literature as the "Peter Principle", which in its most popular version states that "people are promoted to their level of incompetence", and the example frequently cited is the usual quote held by faculty members about the effect of tenure in academic job markets: "individuals seeking for tenure often produce very good work, only to be follows by output far below the pre-tenure level after tenure is awarded" (Carmichael, 1988). The fact that performance is usually imperfectly observed by employers, the presence of downward rigidities in compensations, and the rare frequency of demotions and output-related compensations, makes this strategic behavior possible.

However, a negative impact of previous promotions on the probability of future promotion may also arise if workers need to spend some time to feel comfortable with their new tasks (acquire "job-specific" human capital), or if promotion decisions are decided under other criteria or administrative rules different than performance, such as loyalty, influences, favoritism and other personal relationships, or by privileging the relationship between co-workers by creating an "equal-opportunity" environment (see Milgrom, 1988; Prendergast and Topel, 1996; Fairburn and Malcomson, 2001; Pfann and Hamermesh, 2001). In fact, Prendergast and Topel (1996) suggest that as firms usually rely on subjective supervisors' judgments of employees' performance when selecting the potential candidates to promote, there is always a door open to favoritism (evaluators acting on personal preferences toward subordinates) or bribes: if so, the cost of favoritism may come on the form of arbitrary rewards and less productive job assignments. In absence of verifiability of performance and "principal-agent" contracts, such as output-related compensations, these practices are more likely to emerge.

Most of the literature that focus on inter-firm job mobility (Farber, 1994) or in unemployment duration's spell for displaced workers (Lancaster, 1979), has typically used as sources of information national worker's surveys such as CPS, PSID or NLSY, as most of them have detailed data on both workers' and jobs characteristics (including duration of the job). However, in order to

study job mobility within a firm (intra-firm mobility), these surveys are not ideal since they do not carry detailed information on job assignments within firms or do not consider the interaction of the workers with their partners. Examples that use workers' surveys are McCue (1996), which estimate hazard functions for promotions using PSID data, and Belzil and Bognanno (2004), which condition promotion probabilities to the time spent at previous position using a survey of American executives. Promotions are often decided in a "general equilibrium" basis, and tournament models predict that co-workers' mobility usually matters. Hence, detailed information on worker's, co-workers and job characteristics at the firm level is needed.

Since the pioneer studies of Doeringer and Piore (1971) on internal labor markets, and Baker, Gibbs and Holmstrom (1994 a,b) on careers and wage dynamics, several studies in personnel economics have highlighted the advantage of using personnel records for analyzing intra-firm mobility and compensations (see Lazear, 1999, for a survey). In particular, this paper uses a unique dataset of employment records from a single large U.S. corporation that can account for all the history of every employee that worked for the company during a certain period of time (1989-1994). This dataset was previously used in Gibbs and Hendricks (2003) for exploring salary systems and personnel policies. The advantage of using these records is that it is possible to account for all the decisions made regarding promotions at each period of time. The natural disadvantage and caveat of these type of case studies is that the conclusions only pertains to what happened in a particular firm and it cannot be claimed to represent the bigger picture, so it is necessary to be cautious in interpreting the results as they may be idiosyncratic. However, the evidence is invaluable as the dynamics of the firm's decisions are clearly represented.

Concerning previous studies showing empirical evidence of intra-firm job mobility, none of them has conditioned promotion hazard rates to previous positions at the firm, or have highlighted the potential difference among recently hired and insiders. The first study that dealt with promotion probabilities using personnel records is Medoff and Abraham (1980, 1983), who showed the relationship between promotions, tenure and performance ratings, but due to data limitations they

could not control for previous history, type of job, and other demographic characteristics of the workers. A decade later, Lazear (1992) stressed the relationship between growth in wages and job changes within a firm. Baker, Gibbs and Holmstrom (1994 a) presented evidence of "fast-tracks" using personnel records, in particular calculating job transition matrices between positions within the firm, but again without controlling for job and workers' characteristics. Finally, among the recent studies it is necessary to mention Chiappori, Salanie and Valentin (1999), who highlighted the differences in wages and career paths by distinguishing between "earlier starters" and "late beginners" at a given job position; Gibbs (1995), Lazear (1999) and Gibbs and Hendricks (2003), who focused on the relationship between promotions, wages and performance ratings; Seltzer and Merrett (2000), who analyzed promotions and wage increments in Australia during the XIXth century; Ishida, Kuo and Spilerman (2002), who looked at career paths and promotion to management positions in Japanese and U.S. firms; and Lazear and Oyer (2003), who presented empirical evidence on internal and external job transitions in Sweden firms.

The main findings of this paper are the following: (a) the peak of the promotion hazard rates is registered at exactly one year at the current position, even after controlling for observables characteristics and state dependence; (b) males, whites, and more educated workers have a higher probability of being promoted; (c) there is no evidence of "fast tracks": previous promotions do not imply a higher probability of future promotion; and (d) recent new hires seems to have an advantage when competing with insiders for a higher position. These last two findings seem to be at odds with the hypotheses of "job-specific" and "firm-specific" human capital, and to be in concordance with Lazear's (2004) "Peter Principle" prediction.

The rest of the work this organized as follows. Section 2 describes carefully the data used in the study and presents some descriptive statistics as well as empirical hazard rates and functions for promotions. Section 3 shows the main evidence on the determinants of intra-firm job mobility and suggest some theories that can match the results founded. The paper concludes with brief comments in Section 4.

2. Data and preliminary evidence.

2.1 Data.

The data used in this paper comes from computerized detailed personnel records from a large U.S. firm (over 50,000 employees) with several vertically-integrated businesses (organizational units) for the period January 1989 - August 1994, analyzed previously in Gibbs and Hendricks (2003)[2]. The firm is based in the Midwest, but also has employees in the rest of U.S. Gibbs and Hendricks stressed in their paper that the firm is representative of a typical large U.S. firm by comparing its assets, market value, CEO's compensation, sales and number of employees to some firms in the same industry, the S&P 500, and the universe of firms in the ExecuComp database. Within all comparison groups, the percentile rankings were virtually identical across all measures[3].

The records include all the history of the individuals that have worked for the firm during all or part of the cited period, as well as demographic (age, gender, educational level, marital status) and job characteristics (salary, occupation, organizational unit). Moreover, the firm's personnel department has coded the dates regarding when the individuals entered the firm, any change in their occupational status (promotions, demotions), and when they left the company (although information about the causes of ending are not informed). The dataset also includes compensations (the main focus in Gibbs and Hendricks' paper) and performance rating for each worker; however both are only available either at a yearly base or at job transition dates (i.e., only when a worker is hired, promoted or demoted).

[2] The identity of the corporation must be kept confidential.

[3] They also compared yearly salary increases to those from private sector workers and those in the same industry using BLS data, and the firm also seems representative.

The available data records include all workers in the firm, but only contain detailed movements along a career path starting in 1989. This implies that previous history for those already working in 1989 is not observed. Due to these difficulties, this paper will only analyze job transitions for those hired since 1989. Table 1 shows the composition of the full-time labor force for a particular date in the sample period. The table presents broad fields or occupational descriptions for employees hired after 1989 and working at December 31st, 1993, as well quartiles for annual compensations within each category. Unfortunately, due to the existence of over 14,000 different job codes, it was impossible to present a hierarchy chart[4]. For this subset of 4,091 individuals, 20.5% of them were dedicated to operational and distributions tasks, followed by manufacturing, finance, research and development, marketing, regional affairs and electronic data process as the typical sectors in the firm. It can also be seen that within these broad categories there are different remuneration levels, suggesting that several job levels are present in each field or occupational description.

This description pertains to a particular moment during the sample period under consideration. Between 1/1/1989 and 8/31/1994 (the data period), a total of 6,527 individuals were hired by firm. Of those, 6,428 were full time workers, were never demoted at any point of time, and stayed a minimum of one month in the company. Table 2 contains sample average demographic and job characteristics of the workers and their jobs. The first row presents demographic characteristics for the whole sample. The second line describes the group of employees who has been promoted at least once; the third row is the sub-sample of those with two or more previous positions in the firm, and so on. The total number of positions is 9,497 for those 6,428 individuals.

Table 2 shows that only 35% of the workers in the sample were promoted at least once. Men were more likely to be promoted: while males are 41% of the sample, 53% of those with 4 or more positions in the firm are men. Also, whites were more likely to be promoted (81% of individuals with

[4] Hence, the definition of job transition if different to previous studies that infer them by looking at the movements between job titles (such as in Baker, Gibbs and Holmstrom, 1994 a). In this case, the personnel department classified job changes according to their particular criteria.

3 or more promotions were whites, over a total of 75% of white employees). Although this may be suggesting some sort of discrimination against women and non-whites in promotion decisions, these are just general trends without controlling for other characteristics (such as education, tenure or previous history). Regarding education, those with college and post-graduate degrees were more likely to change positions, and the opposite happened to those with less than college degrees.

Also the chances of being promoted increases with tenure at the firm, although younger workers (age of entry to the firm) were, as it is usually expected, more mobile across positions in the firm. If only tenure at the first position is considered, the table shows that those workers with multiple promotions spent less time at their entry assigned position[5]. Moreover, this difference in timing to first promotion for multiple\y promoted individual is surely understated as most of the leavers where never promoted in the past (81%). Finally, only 25% of the promotions implied changes in occupations (defined by fields or broad categories as in Table 1), although those who had a fruitful history of previous promotions were more likely to switch to a different type of occupation (31% of those with 4 or more positions at the company).

2.2 Hazard Functions for Promotions.

Table 2 shows mean characteristics of workers grouping them according to their history of mobility at the firm. However, it would be also interesting to look at the probability of being promoted conditional on the time spent at the current position. Figure 1 plots the monthly hazard rates for promotion conditional on tenure (at the current occupation). These hazard functions where calculated as $f(t)/\left[1-F(t)\right]$, where *F* is the cumulative density function and *f* is the probability density function of promotions at month *t*. The probability of being promoted in one month is 1.3%,

[5] Similarly, the time spent for a second promotion is less for those with multiple promotions: while those with two promotions stayed an average of 16.6 months at the second position before gaining a new promotion, for those with multiple promotions the waiting time was 12.7 months.

and this probability increases at a maximum of 7% at the twelfth month. In other words, the peak of the probability of promotion is reached at exactly one year of tenure at the current position.

The increase with tenure of the probability of promotion is predicted by learning and matching theories like Jovanovic (1979), who stressed that both firms and workers need time to learn if they are a good match. The hazard plot suggest that this period of "proof" is roughly one year, or at least that promotion decisions are decided after one year of experience at the current position. After a year, the probability of promotion starts to decline until the twenty-fourth month, when there is another peak: this evidence tells that most evaluations seem to take place once a year, a sort of administrative rule. Thereafter, if the employee has not been promoted yet, the probability of ascending in the rank decreases towards zero. Two years of experience at the current job seem to be a sufficiently large period for evaluating if the worker deserves a higher position in the firm. This is consistent with Lazear's (1992) finding that job-to-job turnover within the firm (and also for movements between firms) occurs most frequently at the beginning of the job and dies out thereafter.

Figure 2 shows the quarterly hazards, showing the same behavior of "yearly evaluations": the peaks are always registered at the fourth quarters. Finally, Figure 3 presents the estimated monthly survivor function for promotions in the sample, considering only those jobs which ended in a promotion (not including exits and right-censored positions). Once again, the highest jumps are registered at quarters that correspond to months twelfth and twenty-fourth. These probabilities plotted in Figures 1 to 3 are not conditional on previous promotions: every job at the firm is taken as a single observation, disregarding on previous experience at other positions at the firm.

Table 3 shows the relation between tenure and number of promotions at the firm. This sort of "job transition matrix" clearly shows that promotions are highly related to tenure: those with more experience in the firm have more chances to "climb the corporate ladder". As an example, of those individuals with less than one year of tenure (40% of total), 93% of them kept there original position for which they were hired. This picture changes for those who has an additional year of experience

in the firm (24% of them): 30% of them experience a promotion in their careers, and 3% of them even two promotions. For those with 2 and more years of tenure (36%), is more likely to have at least one change in job than not to have anyone.

This evidence shows that probabilities for promotion change substantially with time spent at the firm and at the current job. However, the estimated hazard functions represent average response for the whole set of workers, without conditioning in demographic and job characteristics of the workers. In order to compute probabilities conditional on observed heterogeneity, Table 4 present estimates using semi-parametric Cox's proportional hazard models. Following Cox and Oakes (1985), the conditional hazard function is assumed to take the form:

$$\lambda\left(t / X\right) = \frac{f\left(t / X\right)}{1 - F\left(t / X\right)} = e^{X\beta}\lambda_0\left(t\right)$$

where λ_0 is the baseline hazard, t represents time, and X a set of workers' demographic and job characteristics. In fact, Cox's model implies a multiplicative separability of the hazard function in X and t. The method implies estimating β by maximizing the partial likelihood:

$$L(\beta) = \prod_i \left[\frac{e^{X_i\beta}}{\sum_{j \in R_t} e^{X_j\beta}} \right]$$

where R_t represents the set of individuals "at risk" (available for promotion) at time t. Note that the baseline hazard does not play any role in estimating β, hence instead of maximizing the full likelihood considering the contribution of λ_0, it is possible to just maximize this partial approximation.

Table 4 shows the result for Cox's proportional hazard estimations conditioning on observable demographics and job characteristics. The dependent variable is the hazard rate for promotion and each job position at the firm for a particular worker represents a single observation. Only positions ending in a promotion were considered, not taking into account jobs ending in an exit or being right-censored. In the first column, only demographic characteristics are included. Single, young and, surprisingly, less educated workers have an advantage with respect to other demographic groups.

However, these estimates do not take into account the type of job performed at the firm. In column 2, controls for job categories are included (those described in Table 1): the main conclusions remain after controlling for these broad occupational categories.

These job occupational categories do not clearly represent job titles or levels. In fact, by looking at Table 1 one can see that within each category there is substantial dispersion regarding wages. It is natural to believe that those at the bottom of the hierarchy should have more chances of promotion than those already at the top. One way to control for job level within occupation is to assign a decil in the distribution of wages in each category to each position. In this way, by adding dummies for job categories and wage deciles, one would be more accurately controlling for job levels at the firm.

Column 3 adds wage deciles, and it can be seen that the hazard rate for promotion is clearly decreasing with the wage level within a particular occupational category. In other words, as pointed out in Lazear (1992), wage levels fully describe the "job ladder" in the firm, making it unnecessary to look at job titles. As well as with the occupational dummies, the LR tests suggest that the addition of these wage deciles controls is appropriate. Other results change dramatically: in particular, the coefficients on education are reversed: conditional on the same job level, more educated workers spent less time before getting a promotion than less educated workers. Hence, the previous negative correlation between education and timing for promotion was just reflecting that less skilled workers were starting at the bottom of the distribution, and that was the explanation of why they were promoted quickly. After controlling for job level, this positive correlation between promotion rates and education can now be associated as either education reflecting higher productivity, or that promotions are decided by credentials (as signals of higher ability). Finally, column 4 only considers the first promotion of this set of workers (i.e., the dependent variable is the hazard rate of the first promotion), but with the exception that for first promotion there is a race differential, the results does not change substantially from those using multiple promotions (column 3).

This complete set of evidence suggests that people differ substantially in their probabilities of being promoted. However, these tables only consider observable characteristics of the workers;

unobserved heterogeneity (to the econometrician) should play an important role in explaining why their employers have different perspective for their careers. Moreover, it is easy to dismiss the possibility that promotions only depend on "fixed" worker heterogeneity without any state dependence: the empirical hazard rates (Figures 1 and 2) are showing that the probability of ascending in the hierarchy of the firm changes with tenure at the current job. Hence, it would be more interesting to condition the hazard rates to previous history. The next section will provide parametric estimates of the determinants of promotions controlling for both demographic characteristics and history.

3. How important is previous history on mobility within the firm?

3.1 Tenure and promotions

Ignoring state dependence as a component of unobserved heterogeneity in the process of being promoted to a superior level in the hierarchy in a firm could seriously mislead any estimate regarding the determinants of promotion hazard rates. As pointed out in Lazear (1992), individuals who remain on the job longer usually do worse than those who are promoted out early. Hence, a way to partially account for unobserved heterogeneity is to control for previous history of the worker. One way is by looking at the number of jobs or positions that a particular worker had during a certain period of time. Table 5 shows the results for ordered probit estimates where the dependent variable is the number of promotions in the history of the worker. For this sub-sample of individuals (6,428), the number of promotions ranges between 0 and 6, hence it calls for a count dependent variable model such as an ordered probit specification as standard linear regression techniques are

not appropriate for these cases[6]. The estimates correspond to the total of workers (columns 1 to 3) controlling for both demographic characteristics, type of entry job, and tenure at the firm. The first specification only controls for demographic characteristics (model 1), while the rest of the equations also controls for job levels using occupational and wage decil dummies (models 2 and 3).

Similarly to the previous Cox's proportional hazard estimations, there seems to be evidence of gender and race discrimination, as men and whites are more likely to be promoted, conditional on having same occupation, education, age, marital status, and tenure at the firm. Married workers also seems to have better chances of being promoted, fact that could be explain by the common belief of many employers that married employees are more stable and less likely to leave the company in the future (Pfann and Hamermesh, 2001). Age also matters: those who have less previous labor experience outside the firm (using age as a proxy) are more likely to experience changes in their occupations at the firm. This could be addressed to the fact that those who lack of previous experience are usually hired for positions for which they are not a good match or where they cannot exploit all their potential, until the firm realizes that they could do a better performance in other type of jobs within the firm, while more experienced workers are usually less likely to accept changes in their tasks. Although not reported, the number of positions at the firm is negatively related to the initial job level (measured by the assigned wage decile at the occupation). Finally, the evidence suggests that more educated (able/productive) workers have higher chances of getting a promotion, again reflecting either higher productivity or else education simple acts as a higher ability signal to the employers.

Column 3 controls for tenure at the firm, as it is natural to believe that people who has spent more time at the firm should have had more experience at previous positions at the company. However, one of the problems with the above estimates is that tenure at the firm can be correlated with

[6] Another option is to perform a Poisson regression. The conclusions are qualitatively the same using this specification, however, due to the high restrictive features of the Poisson distribution (mean equal to the variance), only the results for the ordered probit model are reported here.

unobserved determinants of the number of promotions. In other words, the decision to stay in the firm can be determined by the possibilities of future promotions. If so, previous estimates are inconsistent as they include tenure as a control for the history of the worker in the firm. This can explain the substantial increase in the pseudo R-squared between columns 2 and 3[7]. Moreover, these results include observations for quitters and laid-off workers, people with probably different prospective career paths in the firm having they had stayed. If these sample selectivity issues are important, the previous results are likely to be misleading (this topic is treated with detail in section 3.4). On the other side, it is necessary to control in some way for tenure effects, as is natural to believe that the number of occupations within the firm should depend on the time spent working there (as shown in Table 3).

One way to avoid endogeneity and sample selection problems is to re-estimate the ordered probit models for different tenure-at-the-firm levels. As can be seen in columns 4 to 6 in Table 5, the estimated coefficients are quite different to those in column 3, suggesting that including tenure as a covariate is not recommended. Column 4 includes only workers with less than one year of tenure, column 5 only those between 1 and 3 years of tenure, and column 6 those with more than 3 years of tenure.

The most striking result suggests that age at entry has a different relationship with prior mobility depending on the tenure at the firm level. In the first year, workers who were older at entry had more prior mobility, but by the time the worker reaches more than one year of tenure at the firm, workers who were older when they entered had fewer positions[8]. Finally, at the beginning those with higher education does not seem to change positions earlier than less skilled workers, although after

[7] The computed pseudo R-squared was originally proposed in McFadden (1994). He suggested the measure $1 - L_{ur} / L_0$, where L_{ur} is the log-likelihood function for the estimated model and L_0 is the log-likelihood function in the model with only one intercept.

[8] A similar result is founded in Farber (1994) for interfirm job mobility. While among workers with one year of experience at the current job, older workers at entry had more previous jobs, this relationship is reversed for workers with five years of experience (i.e., young workers have more prior mobility).

spending certain period working by the firm, they seem to have an advantage in gaining promotion. This evidence suggest that education seems to be truly correlated with ability or more rapid acquisition of "firm-specific" human capital, and not constituting merely a signal, otherwise the advantage for more educated workers should show up earlier at the firm.

3.2 State Dependence, the Peter Principle, and the role of New Hires

The previous results only focus on the differences across demographic groups in the number of jobs within the firm, but does not control for the history of each particular worker. In particular, it is possible to infer how individuals will differ in their future careers in the firm by looking at what happened to them in the past. If employers decide promotions on productivity bases, and if productivity within a firm depends on the natural ability of certain workers to perform better than their partners, it is naturally to believe that those who were promoted in the past will be more likely to ascend in the hierarchy again in a short period.

However, several theories have predicted a negative relationship between past and future promotions. Lazear (2004) showed that output after promotion is statistically expected to fall: as being promoted is evidence that a standard has been met, regression to the mean implies that future productivity should decline on average. To clarify this statement, consider a two-period model. Ability is distributed across workers according to *G(a)*. At period 1, each worker makes a draw *a* from *G(a)* and her ability remains for the second period. Moreover, in each period the worker is confronted to an i.i.d. productivity shock u_t, distributed as *H(u)* with zero mean and constant variance. The firm can only observe $p_t = a + u_t$ but cannot distinguish among its different components. In the first period, the firm observes p_1 for the worker and decides promotion according to some criterion level, such that p being greater or equal than p*. The expected value of u_t conditional on being promoted is given by

$$E(u_t / a + u_t > p^*) = \int_{-\infty}^{\infty} \int_{p^*-a}^{\infty} \frac{u}{1 - H(p^* - a)} dH(u) dG(a)$$

As the unconditional expectation of *u* is zero, the conditional expectation of *u* being *u* greater than any number is positive. So, the conditional expectation of u_t is positive among those who were promoted. Finally, due to the independence assumption between u_t and u_{t+1}, the expected performance falls for promoted individuals between *t* and *t+1*, as

$$E(p_t) = a + E\left(u_t / a + u_t > p^*\right) > a + E\left(u_{t+1} / a + u_t > p^*\right) = E\left(p_{t+1}\right)$$

Strategic behavior from part of the workers can also predict that individuals may perform worse after receiving a promotion: the Lazear's (2004) version of the Peter Principle suggests that those promoted in the past due to their "outstanding" performance may have now fewer incentives to maintain high levels of efforts once promoted. Finally, if promoted workers slowly accommodate to their new position and duties, they may have a disadvantage with respect to those who have been working at the same occupation for a long time and have acquired more "job-specific" human capital[9].

The role of "new hires" is another issue: typically, it is difficult to observe the previous history for those recently hired. Hence, it is not possible to partially offset the unobserved heterogeneity problem for new hires by looking at past performance. This fact suggests that it is necessary to distinguish among insiders and new hires when estimating promotion equations. If new hires does not differ substantially in quality from insiders, and if "firm-specific" human capital is an important component of the skill of a particular worker, conditional on being a the same job level and having spent the same amount of time at the current job, it is naturally to expect a sort of disadvantage in terms of future promotions for workers recently hired. On the other hand, if the firm only hires

[9] This could be a plausible explanation only if individuals do not differ much in the rate at which they learn; in this way, those promoted quickly once may need to wait longer for their next promotion.

"super-productive" workers, i.e., people with really outstanding perspective in the future career at the firm, the "new-hire" effect would be the opposite.

In order to explore how these issues related to the role of state dependence influence the probability of being employed, a probit model for a dependent variable equal to 1 if the worker was promoted in the month of reference and 0 otherwise can be estimated. This specification is more suitable than a Cox's proportional hazard model, as the latter usually does not deal properly with individual effects (unobserved heterogeneity). Among the independent variables, controls for previous promotions are included. The panel includes monthly observations for every individual that worked for the firm during any period between January 1989 and July 1994.

One of the issues that need to be addressed is the treatment of the individual effects. The specification adopted here is an unobserved effects Probit model of the form:

$$P\left(y_{it} = 1 / x_{it}, \mu_i\right) = \Phi\left(x_{it}\beta + \mu_i\right)$$

where y is promotion outcome (1 if promoted, 0 otherwise), $i = 1,\ldots, N$ denotes the set of workers, and $t = 1,\ldots,T$ the time index (in months), μ_i represents the individual effects, and Φ is the cumulative normal distribution function. Due to the incidental parameters problem, is not possible to use fixed effects method to estimate the individual parameters with T fixed and $N \rightarrow \infty$. Unlike in the linear case, estimating the μ_i would lead to inconsistent estimation of β. Hence, the approach taken here is to treat the problem as a traditional random effects Probit model[10]. Unfortunately, for estimating this model it is necessary to make a restrictive assumption regarding the relationship x and μ. This is the following:

$$\mu_i / x_i \sim N\left(0, \sigma_\mu^2\right)$$

[10] An alternative is to estimate a fixed effects logit model. A problem with this approach is that, unlike the probit random effect model, it requires the dependent variable to be serially uncorrelated after conditioning on x and μ, an unreasonable assumption for the promotion case. Besides, it does not allow the estimation of average partial effects (it does not estimate the individual parameters, only a demeaned specification).

where x_i is a vector of ($x_{i1},...,x_{iT}$) for every *i*. In other words, μ_i and x_i should be independent and μ_i should have a normal distribution. Under this assumption, a conditional maximum likelihood approach is available for estimating both β and σ_μ. This requires finding the joint distribution of $(y_{i1},\ldots, y_{iT})$ conditional on x_i and integrating out μ_i. Since μ_i has normal distribution conditional on x_i,

$$f\left(y_1,...,y_T / x_i;\beta;\sigma_\mu\right)=\int_{-\infty}^{\infty}\left[\prod_{t=1}^{T}\Phi\left(x_t\beta+\mu\right)^{y_t}\left[1-\Phi\left(x_t\beta+\mu\right)\right]^{1-y_t}\right]\left(1/\sigma_\mu\right)\phi\left(\mu/\sigma_\mu\right)d\mu$$

where ø is the normal p.d.f. Hence, the log-likelihood function for the entire sample can be maximized with respect to those parameters. The relative importance of the unobserved heterogeneity effect is measured by $\rho=\frac{\sigma_\mu^2}{\sigma_\mu^2+1}$, which also represents the correlation of the error term $\mu_i + \varepsilon_{it}$ across time. The random effects assumption, although somehow restrictive, is usually made when estimating panel data probit models, as it avoids the computational difficult task of integrating a T-dimension multivariate normal distribution function.

Table 6 shows the results of applying this random effects Probit specification. The first four columns present results for the first occupation in the firm for every employee (6,428). Because the probability of promotion in any month is small (less than 10%), the coefficient estimate is approximately the average proportional marginal effect of the variable. Column 1 only controls for demographic characteristics: there seems to be no evidence of gender differences in the probability of promotion, but this is not true regarding race: conditional on the same covariates, whites have higher chances of ascending in the hierarchy of the firm than non-whites (about 9% more). There is a quadratic relationship between age (at entry) and the probability of promotion: middle-age workers have less chances of promotion. Besides, more educated people seem to have a positive differential for “climbing the corporate ladder” (post-graduates have 10% more probability than those with incomplete college education).

Model 2 introduces yearly dummy variables in order to capture the overall performance of the firm that may affect the careers of all workers at the same time: there are no substantial differences in

the estimates. Model 3 adds controls for working at different organizational units, and job levels, captured by both occupational categories and wage deciles within each category. Similarly to Column 3 in Table 4, the coefficients on wage deciles (not reported) exhibit a declining pattern according to the position at the occupational ladder (those at the bottom have a higher probability of promotion). The other results change substantially: age is no longer significant, once again suggesting that the advantage in the probability of future promotion for young people captured in the previous specification was probably due to the fact that they were starting at lower level in the hierarchy. The same happens with education: the impact of a higher degree is much more important (24% more probability of promotion for post-degrees with respect to those with incomplete college education) conditional on being at the same job level.

Column 4 performs the same analysis but this time controlling for tenure at the current job. The results for the different demographic groups remain, but what it is more interesting, the tenure coefficients show the same pattern that those visualized in Figure 2: the probabilities of promotion are greater at quarters 4 and 8, i.e., after a complete year period. So, even after controlling for observable differences the evolution of yearly peaks remain. Promotion decisions are made mostly after the worker complete a year period working at the current position.

Starting in column 5, controls for state dependence are added, considering first only up to the initial two occupations for every employee (a total of 8,681 positions). Having a previous promotion at the firm seems to reduce the probability of a future promotion in the firm. One important consideration with the interpretation of this coefficient is the following: if two workers are at the same job level, but only one has a previous promotion, it means that the other one is a worker hired directly for that position. In other words, the “previous promotion” variable is capturing the differential effect of being a new hire versus being promoted from below (“insider”).

This result may both corroborate that the firm only hires “super-productive” workers, i.e., people with really outstanding perspective in the future career at the firm (Carrillo, 2003), and that the returns to “firm-specific” human capital (Carmichael, 1983) are low or negligible. Besides, it agrees with

Lazear's (2004) version of the Peter Principle, who state that workers in seek of promotion "out-perform" by more that there natural capabilities in their current position, and "relax" thereafter[11], if promotions are closely related to performance. Moreover, it also contradicts the suggestion of Baker, Gibbs and Holmstrom (1994a) of substantial presence of "fast tracks" in careers. Finally, as mentioned before, this negative correlation between past and future promotions could also be due to the lack of "job-specific" human capital in recently promoted workers.

It is necessary to discriminate between these conflicting theories that can potentially explain the same fact. First, column 6 controls for tenure at the job. If "job-specific" human capital is what most matters, the negative correlation between previous promotions and future promotions should disappear after controlling for the time spent on the current job. The results suggest that this is not the case here: for two individuals with the same tenure at current job, the one who experienced a previous promotion has still a lower probability of ascending in the hierarchy.

One way to test for negligible returns to "firm-specific" human capital ("new-hires" effect) vs. a story based on declining performance for recently promoted (Lazear's (2004) Peter Principle) would be by including tenure at the firm as a control variable. However, this is not advisable as it is natural to believe that the decision to stay at a particular firm depends in part on the probability of getting a promotion; if so, tenure at the firm is an endogenous variable in the promotion equation. In order to overcome this problem, the approach taken here is to add the third occupation for those who had the chance to be promoted twice, and control for the fact of having two promotions in the history at the firm: in this way, the "new-hire" effect will not be present.

Column 7 presents the estimates for those individuals with either one or two previous promotions (2,906 workers): conditional on tenure at the job and demographic characteristics, there is no systematic difference in future promotion between those who where promoted one versus those

[11] Chiappori, Salanie and Valentin (1999) shows that an analogue version of the Peter Principle for wages requires that after controlling for wages and job title at date t, the wage at date t+1 should be negatively correlated with the wage at date t-1. This result is there defined as "late-beginner" property.

who were promoted twice. Hence, the negative effect of previous promotions is only valid for the first promotion: in other words, the evidence seems to be only capturing the advantage that new hires have over insiders in future promotion decisions. “Firm-specific” human capital does not seem to be important in this case. At the same time, this evidence is somehow against the “Peter Principle” prediction, which would imply the corollary that incentives to overproduce should fall with the number of previous positions. However, it is not at all conclusive as, first, the “Peter Principle” could still be holding for the firsts promotions, and second, the number of workers with more than two promotions in their history is substantially small due to the relative short period considered (see Table 3), and thereby the estimates could not be so reliable.

Looking at people who have already had a previous promotion allows for controlling for another dimension of individual heterogeneity. In particular, it is possible to condition the probability of future promotion not only to tenure at the current job, but also to the time spent at the previous job. Column 8 performs the same estimation as in Column 7, but this time also including tenure at the previous occupation (in months). Conditional on same job level and tenure at the current job, those who spent less time at the previous job do not have a greater probability of promotion, i.e., these workers do not seem to be qualitatively different than those who took longer to reach the actual position. Again, this evidence contradicts the idea of “fast tracks” inside the firm, as in Baker, Gibbs and Holmstrom (1994a). There is still no difference among those who where promoted one versus those who were promoted twice.

An alternative way to control for the differential impact among new hires and insiders is presented in column 9. This specification includes all the occupations for every employee and set controls for the number of previous promotions. All the coefficients on previous promotions are negative, suggesting that new hires have a decisive advantage over insiders. Again, a story based on a predominating “Peter Principle” effect would imply that the coefficient of those with more than three promotions should be more negative than those with two promotions, and in turns the latter should be more negative than the one corresponding to those with only one promotion in their history. However, the

equality of those coefficients cannot be rejected (p-value 0.6755). Once again, if present, the "Peter Principle" seems to hold only for the first promotion.

Finally, in order to highlight the importance of state dependence (past promotions) in the probability of future promotion, Table 7 shows the predicted probabilities of promotion for a particular worker (a 25 year-old non-white male with incomplete college education and recently incorporated at a median wage level position at the operation and distribution department at one of the organizations of the company during 1989) using the coefficients from model 9 in Table 6. If the worker has no previous promotions (i.e., was directly hired for that position), the conditional predicted probability of being promoted at anytime within a year is 45.5%, while this number is substantially reduced for a worker with the same characteristics but with one previous promotion (i.e., an "insider"): 24.3%. Hence, in some cases previous history can account for nearly half of the differences in promotion probabilities among apparently similar workers.

3.3 Variation across workforce groups.

Do these results vary substantially across different workforce groups? Table 8 present estimates of the probabilities of promotion for sub-samples of the workforce: the groups are differentiated according to gender, race, education and occupation. Regarding the last classification, two typical broad categories of occupations at the firm were selected according to their higher number of observations relative to other tasks: operations and distributions (a typical "blue collar" occupation) and finance (typically "white collar"). As only 25% of the promotions represented changes in occupations, this distinction reflects in fact different tracks for a typical employee entering the firm at one of these job occupational categories. Once again, within these occupations, job levels are identified according to the relative position in the distribution of wages.

For all cases, previous promotions are negatively correlated with the probability of future promotion, suggesting that the advantage for new hires is present across all demographic and occupational

groups. For certain subgroups, notably blue collar and less educated workers, the evidence is also consistent with Lazear's (2004) Peter Principle prediction, as not only the coefficients for previous promotion are decreasing with the number of past outcomes, but also their equality is rejected using traditional Wald tests. Hence, for those subgroups, the incentives to over-perform seem to be even lower for individuals with multiple past promotions. This does not seem to be true for more educated and skilled workers.

Additionally, the main results for other demographic subgroups are the following: a) gender differences only appear among whites, less educated workers and blue-collars (at least in a typical "man" job as operations and distributions); b) racial discrimination seems to be present across all demographic groups; c) the relationship among tenure at the current job and future promotion is consistent across all subgroups (with peaks at the end of each year); and d), notably, in certain white-collar activities such as finance, non of the demographic characteristics are relevant, suggesting either a strong presence of unobserved heterogeneity, or that the estimates are imprecise due to the lack of enough observations.

3.3 Sample selectivity issues

One of the reader's concerns may come from the fact that these estimates include observations for all the individuals that have worked for the firm during at least one month between January 1989 and July 1994. Among those individuals there are "leavers": those who quit to work outside the company, retired, died, or were laid off. It would be important to ask the counterfactual question of what probability of promotion would have those who left the company. Probably leavers were those who have less probability of promotion and hence decided to find a better job match in another company, or were just fired as their performance was lower than what the firm expected. It is

infrequent that a firm demotes their employees[12]; instead of doing that, employers usually prefer to lower wages or just to fire the worker (Gibbons and Waldman, 1999). Or maybe those who quitted where those outstanding workers that had received better offers from outside, so their probability of promotion was indeed higher. In any case, it is not simple to predict the sign of the sample selection bias.

Unfortunately, it is not possible to distinguish from the dataset the reasons for leaving the company[13]; hence, sample sensitivity analysis by including and excluding quitters and laid-off workers cannot be performed in this case. But it is possible at least to measure the strength of the bias by excluding all the observations for those who left the firm before August, 1994. This reduces the sample size from 6,428 employees to 3,964; the total number of positions from 9,497 to 6,465; and the total monthly observation for each worker in each position from 124,252 to 90,005. The results for non-leavers are shown in Table 9. The main conclusions remain: most of the demographic variables have the same influence on the probability of promotion, the state dependence variables have the similar effect, and the shape of the impact of the tenure profile on the promotion probabilities keeps its peaks at the fourth and eight quarters. The only difference is regarding gender: if promotions decision are made according to productivity bases in this firm, it seems that either outstanding men and/or less productive women are more likely to leave (or be fired), as there are no gender differences when looking only at “non-leavers”. In any case, sample selectivity issues do not seem to be biasing substantially the results.

[12] Only 0.43% of the changes in job positions within the firm were demotions.
[13] Although as mentioned earlier (Section 2.1), 81% of the “leavers” were never promoted, suggesting that a positive bias toward “stayers” is more likely to be present.

4. Synthesis and Conclusions

This paper shows estimates of the probability of ascending in the hierarchy of a firm (promotion) using personnel record data. The main conclusions are: (a) the peak of the promotion hazard rates is registered at exactly one year at the current position, even after controlling for observables characteristics and state dependence; (b) males, whites, and more educated workers have a higher probability of being promoted; (c) there is no evidence of "fast tracks": previous promotions do not imply a higher probability of future promotion; and (d) recent new hires seems to have an advantage when competing with insiders for a higher position.

These results may corroborate that the firm only hires "super-productive" workers (people with really outstanding perspective in the future career at the firm), and/or that the returns to "firm-specific" human capital are low or negligible. Besides, it indirectly agrees with the Peter Principle suggested by Lazear (2004), although the effect does not remain after gaining the first promotion. It also suggest that "job-specific" human capital theories are not useful for explaining what is happening inside this firm, as the negative correlation between previous and future promotions remains even after controlling for tenure at the current job, and that there is no evidence of "fast tracks" in careers, as suggested in Baker, Gibbs and Holmstrom (1994 a).

However, other alternative explanations for this fact that does not allude to promotions tied to performance can be suggested. If promotions are not based solely on productivity, but decided instead under other criteria or administrative rules different than performance, such as loyalty, influences, favoritism and other personal relationships, or by privileging the relationship between co-workers by creating an "equal-opportunity" environment, this result can be accounted by those alternative theories. Unfortunately, it is difficult to distinguish among them with the information available. In any case, what is reflected is that those with a successful history at the firm do not seem to have an advantage when future promotions are made.

References

Baker, G., Gibbs, M., and Holmstrom, B. (1994a). “The Internal Economics of the Firm: Evidence from Personnel Data”. Quarterly Journal of Economics, 109, 881-919.

Baker, G., Gibbs, M., and Holmstrom, B. (1994b). “The Wage Policy of a Firm”. Quarterly Journal of Economics, 109, 921-955.

Baker, G., Jensen, M., and Murphy, K. (1988). “Compensation and Incentives: Practice vs. Theory”. Journal of Finance, 43, 593-616.

Bernhardt, D. (1995). “Strategic Promotion and Compensation”. Review of Economic Studies, 62, 315-339.

Bernhardt, D. and Scoones, D. (1993). “Promotions, Turnover, and Preemptive Wage Offers”. American Economic Review, 84, 771-791.

Belzil, C. and Bonagnno, M. (2004). “The Promotion Dynamics of American Executives”. IZA Discussion Paper 1003.

Carmichael, L. (1983). “Firm-Specific Human Capital and Promotion Ladders”. Bell Journal of Economics, 14, 251-258.

Carmichael, L. (1988). “Incentives in Academics: Why is There Tenure?”. Journal of Political Economy, 96, 453-472.

Carrillo, J. (2003). “Job Assignment as a Screening Device”. International Journal of Industrial Organization, 21, 881-905.

Chiappori, P., Salanie, B., and Valentin, J. (1999). “Early Starters versus Late Beginners”. Journal of Political Economy, 107, 731-760.

Cox, D. and Oakes, D. (1985). Analysis of Survival Data. Chapman and Hall, New York.

Doeringer, P. and Piore, M. (1971). Internal Labor Markets and Manpower Analysis. Lexington, MA: D.C. Heath and Company.

Fairburn, J. and Malcomson, J. (2001). “Performance, Promotion, and the Peter Principle”. Review of Economic Studies, 68, 45-66

Farber, H. (1994). “The Analysis of Interfirm Worker Mobility”. Journal of Labor Economics, 12, 554-593.

Gibbons, R, and Waldman, M. (1999). “A Theory of Wage and Promotion Dynamics”. Quarterly Journal of Economics, 114, 1351-1358.

Gibbs, M. (1995). “Incentive Compensation in a Corporate Hierarchy”. Journal of Accounting and Economics, 19, 247-277.

Gibbs, M. and Hendricks, W. (2003). “Are Formal Salary Systems a Veil?”. Industrial and Labor Relations Review, forthcoming.

Ishida, H., Kuo, H., and Spilerman, S. (2002). “Models of Career Advancement in Organizations”. European Sociological Review, 18, 179-198.

Jovanovic, B. (1979). “Job Matching and the Theory of Turnover”. Journal of Political Economy, 87, 972-990.

Lazear, E. (1992). “The Job as a Concept”. In Performance Measurement, Evaluations, and Incentives, ed. W. Bruns. Boston: Harvard Business School Press.

Lazear, E. (1999). “Personnel Economics: Past Lessons and Future Directions”. Journal of Labor Economics, 17, 199-236.

Lazear, E. (2004). “The Peter Principle: A Theory of Decline”. Forthcoming, Journal of Political Economy.

Lazear, E. and Oyer, P. (2003). “Internal and External Labor Markets: A Personnel Economics Approach”. NBER Working Paper 10192.

Lazear, E. and Rosen, S. (1981). “Rank-Order Tournaments as Optimal Labor Contracts”. Journal of Political Economy, 89, 841-864.

Lancaster, T. (1979). “Econometric Methods for the Duration of Unemployment”. Econometrica, 47, 939-956.

McCue, K. (1996). “Promotions and Wage Growth”. Journal of Labor Economics, 14, 175-209.

McFadden, D. (1974). “Conditional Logit Analysis of Qualitative Choice Analysis”. In Frontiers in Econometrics, ed. P. Zarembka. New York: Academic Press.

Medoff, J. and Abraham, K. (1980). “Experience, Performance, and Earnings”. Quarterly Journal of Economics, 95, 703-736.

Medoff, J. and Abraham, K. (1983). “Years of Service and Probability of Promotions”. NBER Working Paper 1191.

Milgrom, P. (1988). “Employment Contracts, Influence Activities, and Efficient Organization Design”. Journal of Political Economy, 96, 42-60.

Prendergast, C. (1993). “A Theory of ‘Yes Men’”. American Economic Review, 83, 757-770.

Prendergast, C. and Topel, R. (1996). “Favoritism in Organizations”. Journal of Political Economy, 104, 958-978.

Seltzer, A. and Merrett, D. (2000). “Personnel Policies at the Union Bank of Australia: Evidence from the 1888-1900 Entry Cohorts”. Journal of Labor Economics, 18, 573-613.

Table 1: Job Categories at December 31th, 1993

Job Categories	Number	%	Wages		
			1 Q	Median	3 Q
Executive Management	13	0.3	34,560	37,742	161,000
Business Planning	29	0.7	32,500	52,000	60,000
Administratives	52	1.3	19,690	24,811	44,942
Human Resources	174	4.3	26,438	35,893	54,808
Corporate Finance	26	0.6	30,000	31,072	31,813
Finance	602	14.7	13,908	18,222	35,700
Regional Affairs	340	8.3	25,914	35,000	47,624
Legal	30	0.7	26,000	29,006	39,128
Public Affairs	4	0.1	28,050	36,550	41,750
Marketing Management	372	9.1	25,000	35,431	55,000
Operations / Distributions	838	20.5	20,436	23,310	28,392
Manufacturing	525	12.8	24,500	35,363	43,814
Sales Representatives	176	4.3	31,469	39,323	44,089
Sales Management	78	1.9	22,944	26,691	57,666
Research and Development	482	11.8	33,060	42,450	54,868
Electronic Data Process	233	5.7	31,700	37,500	43,641
Health Care	100	2.5	20,000	21,820	22,856
Scientific Affairs	17	0.4	24,000	44,442	55,650
Total	4,091	100.0	22,104	31,000	43,600

Note: Workers hired after January 1st, 1989.

Table 2: Employee's Characteristics - 1989/1994

Positions in the Firm	Number of Employees	Men	Whites	Married	Some College	College	Post Degree	Avg. Age at Entry	Avg. Tenure at Firm	Avg. Tenure at First Pos.	Changing Job
		%	%	%	%	%	%	Years	Months	Months	%
1	6,428	41.26	75.36	53.31	41.35	42.25	16.40	31.48	11.99	11.99	-
2	2,253	43.68	77.76	56.24	34.93	46.60	18.46	29.81	26.92	10.34	23.86
3	653	46.25	79.79	57.58	32.01	49.92	18.07	27.91	36.90	8.71	24.51
4 or more	163	52.76	80.98	57.67	23.31	58.28	18.40	26.56	44.82	8.04	31.14

Note: The sample contains all the individuals that were hired after 1/1/1989 until 8/31/1994. The number of hires during this period is 6,428 and their characteristics are reflected in the first row. The second row corresponds to the subsample of those workers who has been promoted at least once.

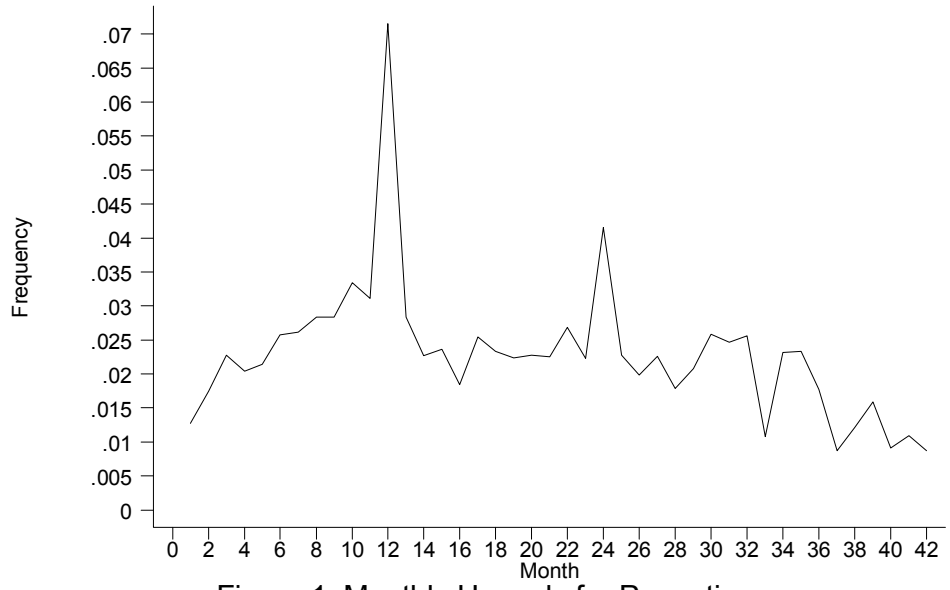

Figure 1: Monthly Hazards for Promotion

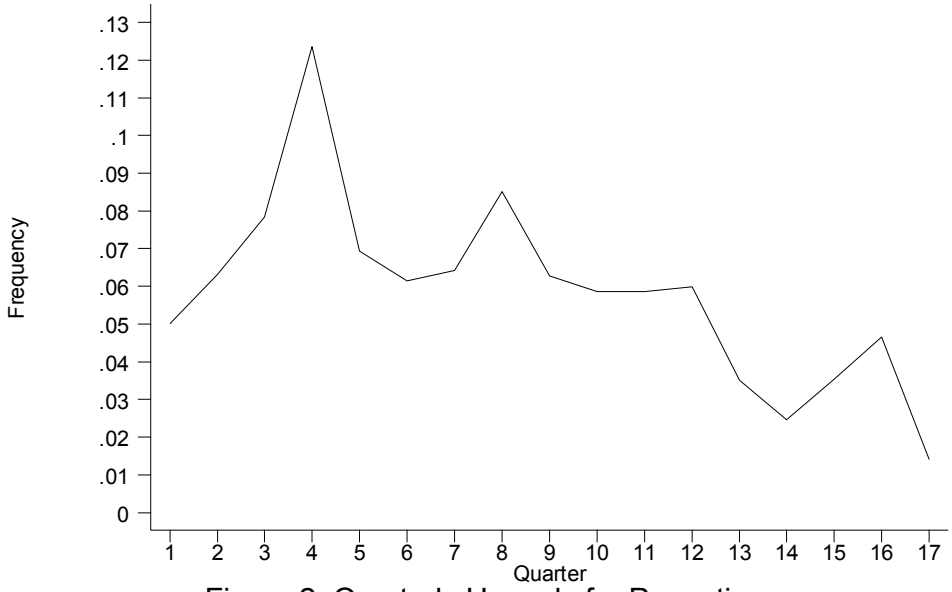

Figure 2: Quarterly Hazards for Promotion

Figure 3: Kaplan-Meier Survival Plots for Promotions

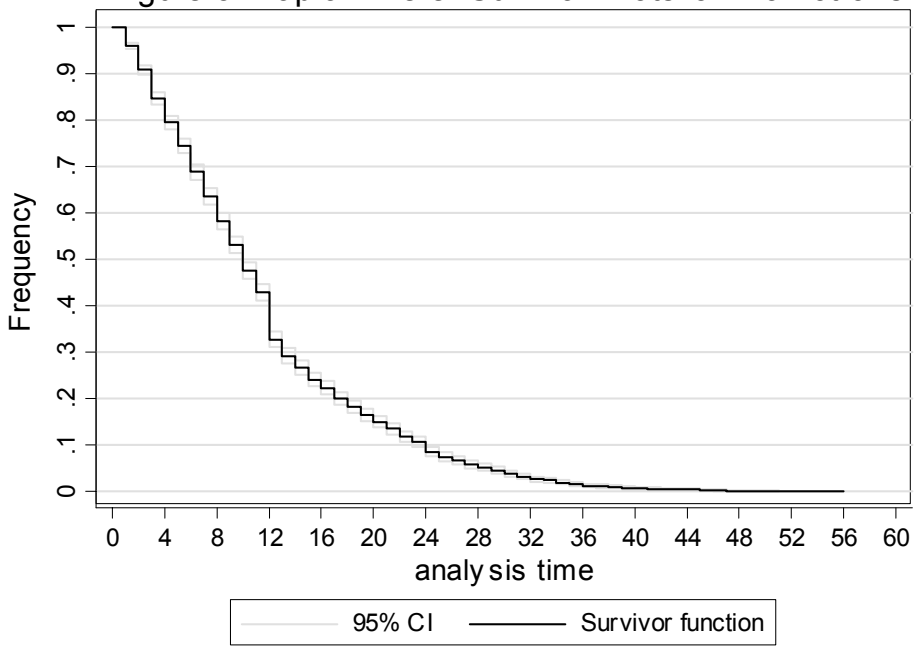

Table 3: Number of Promotions and Tenure at the Firm - 1989/1994

Tenure at the Firm	Number of Promotions				Total Workers
	0	1	2	3 and More	
Less than 1 year	2,419	172	6	0	2,597
Between 1 and 2 years	1,031	452	52	5	1,540
Between 2 and 3 years	402	466	138	18	1,024
Between 3 and 4 years	257	391	213	43	904
More than 4 years	61	128	109	65	363
Total workers	4,170	1,610	520	131	6,428

Table 4: Cox's Proportional Hazard Estimates for Promotions - 1989/1994

Variables	Model			
	(1)	(2)	(3)	(4)
Men	-0.0468	-0.0586	0.0645	0.0032
	(0.0375)	(0.0396)	(0.0408)	(0.0479)
Married	-0.0799**	-0.0651*	-0.0378	-0.0327
	(0.0384)	(0.0388)	(0.0391)	(0.0455)
White	0.0206	0.0098	0.0576	0.1096**
	(0.0443)	(0.0450)	(0.0452)	(0.0524)
Age (at entry)	0.0334*	0.0381**	0.0818**	0.0817**
	(0.0184)	(0.0186)	(0.0190)	(0.0214)
Age Squared (at entry)	-0.0004*	-0.0005*	-0.0010**	-0.0011**
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
College	-0.1419**	-0.1097**	0.2462**	0.1309**
	(0.0426)	(0.0441)	(0.0513)	(0.0592)
Post-Degree	-0.2845**	-0.2220**	0.3139**	0.1437*
	(0.0545)	(0.0572)	(0.0702)	(0.0809)
Second Wage Decile			-0.3208**	-0.2577**
			(0.0876)	(0.0982)
Third Wage Decile			-0.4822**	-0.3225**
			(0.0885)	(0.0997)
Fourth Wage Decile			-0.6765**	-0.5313**
			(0.0847)	(0.0933)
Fifth Wage Decile			-0.7564**	-0.6608**
			(0.0880)	(0.0962)
Sixth Wage Decile			-0.8757**	-0.7549**
			(0.0899)	(0.1006)
Seventh Wage Decile			-0.9164**	-0.7964**
			(0.0921)	(0.1067)
Eighth Wage Decile			-1.0248**	-0.9185**
			(0.0919)	(0.1039)
Ninth Wage Decile			-1.1745**	-0.9610**
			(0.0958)	(0.1124)
Tenth Wage Decile			-1.4637**	-1.2621**
			(0.1154)	(0.1386)
Occupational Dummies	No	Yes	Yes	Yes
Observations	3,067	3,067	3,067	2,252
Partial Log Likehood	-21,708	-21,693	-21,585	-15,183
LR Test (p-value)	-	0.0275	0.0000	-

Notes: Asymptotic standard errors in parentheses. * Significant at 10% level. ** Significant at 5% level.

Only job positions ending in promotion are taken into account.

Table 5: Ordered Probit Estimates for Number of Promotions - 1989/1994

Variables	Total Workers			Tenure (years)		
				$t \leq 1$	$1 < t \leq 3$	$t > 3$
	(1)	(2)	(3)	(4)	(5)	(6)
Men	0.0605*	0.0792**	0.0380	-0.0145	0.0151	0.1142*
	(0.0317)	(0.0346)	(0.0376)	(0.0862)	(0.0518)	(0.0683)
Married	0.2476**	0.2594**	0.1023**	0.1128	0.0842*	0.1124*
	(0.0326)	(0.0330)	(0.0362)	(0.0844)	(0.0498)	(0.0654)
White	0.1341**	0.1484**	0.1708**	0.1939**	0.1224**	0.2219**
	(0.0361)	(0.0368)	(0.0406)	(0.0959)	(0.0558)	(0.0736)
Age (at entry)	-0.0483**	-0.0200	-0.0268*	0.0851**	-0.0746**	-0.0759**
	(0.0137)	(0.0144)	(0.0159)	(0.0379)	(0.0216)	(0.0290)
Age Squared (at entry)	0.0002	-0.0001	0.0000	-0.0014**	0.0006**	0.0005
	(0.0002)	(0.0002)	(0.0002)	(0.0005)	(0.0003)	(0.0004)
College	0.1822**	0.3059**	0.1957**	-0.0168	0.1924**	0.4058**
	(0.0346)	(0.0393)	(0.0438)	(0.0918)	(0.0620)	(0.0814)
Post-Degree	0.2875**	0.5558**	0.4020**	0.0680	0.4110**	0.5411**
	(0.0458)	(0.0556)	(0.0615)	(0.1387)	(0.0844)	(0.1096)
Tenure at firm (betw 1 and 2 years)			1.0701**			
			(0.0508)			
Tenure at firm (betw 2 and 3 years)			1.7781**			
			(0.0538)			
Tenure at firm (betw 3 and 4 years)			2.0987**			
			(0.0557)			
Tenure at firm (more than 4 years)			2.6440**			
			(0.0725)			
Occupational Dummies (at entry job)	No	Yes	Yes	Yes	Yes	Yes
Wage Deciles (at entry job)	No	Yes	Yes	Yes	Yes	Yes
Observations	6,428	6,428	6,428	2,597	2,564	1,267
Log Likehood	-5,680	-5,541	-4,315	-639	-2,279	-1,504
LR Test (p-value)	-	0.0000	0.0000	-	-	-
Pseudo R-Squared	0.0287	0.0525	0.2621	0.0538	0.0420	0.0660

Notes: Asymptotic standard errors in parentheses. The pseudo r-squared is that proposed in McFadden (1974). * Significant at 10% level. ** Significant at 5% level.

Table 6: Probit Estimates of Monthly Promotion Rates - 1989/1994

Variables	Previous Positions at the Firm								
	0				1 or 0		Between 1 and 2		All Positions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-1.2244**	-1.2290**	-1.7270**	-1.9256**	-1.7429**	-1.9875**	-2.4935**	-2.3895**	-1.9897**
	(0.1428)	(0.1501)	(0.2992)	(0.2462)	(0.2374)	(0.2391)	(0.4215)	(0.4227)	(0.2157)
Men	0.0033	-0.0031	0.0238	0.0256	0.0388**	0.0398**	0.1164**	0.1149**	0.0457**
	(0.0194)	(0.0195)	(0.0213)	(0.0214)	(0.0186)	(0.0192)	(0.0340)	(0.0339)	(0.0187)
Married	0.0468**	0.0430**	0.0627**	0.0612**	0.0639**	0.0618**	0.0823**	0.0836**	0.0610**
	(0.0196)	(0.0197)	(0.0202)	(0.0203)	(0.0175)	(0.0180)	(0.0329)	(0.0328)	(0.0174)
White	0.0870**	0.0906**	0.0887**	0.0863**	0.0810**	0.0819**	0.0094	0.0080	0.0784**
	(0.0221)	(0.0222)	(0.0229)	(0.0229)	(0.0203)	(0.0209)	(0.0400)	(0.0398)	(0.0204)
Age (entry)	-0.0332**	-0.0330**	-0.0057	-0.0049	-0.0113	-0.0107	-0.0390**	-0.0413**	-0.0115
	(0.0085)	(0.0085)	(0.0091)	(0.0094)	(0.0085)	(0.0087)	(0.0192)	(0.0193)	(0.0085)
Age Squared (entry)	0.0002*	0.0002*	-0.0001	-0.0001	-0.0001	-0.0001	0.0003	0.0003	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0003)	(0.0001)
College	0.0622**	0.0567**	0.1326**	0.1267**	0.1298**	0.1284**	0.1267**	0.1238**	0.1357**
	(0.0214)	(0.0216)	(0.0247)	(0.0252)	(0.0218)	(0.0225)	(0.0444)	(0.0443)	(0.0219)
Post-Degree	0.0969**	0.0900**	0.2403**	0.2340**	0.2357**	0.2355**	0.2502**	0.2485**	0.2418**
	(0.0276)	(0.0277)	(0.0343)	(0.0337)	(0.0295)	(0.0302)	(0.0621)	(0.0621)	(0.0187)
1 Previous Promotion ("Insider')					-0.2637**	-0.2790**			-0.2793**
					(0.0183)	(0.0188)			(0.0378)
2 Previous Promotions							-0.0306	-0.0236	-0.3134**
							(0.0423)	(0.0429)	(0.0366)
3 or more Previous Promotions									-0.2964**
									(0.0887)
Tenure at previous job (months)								-0.0036	
								(0.0026)	
Tenure at current job (bw 1 and 2 quarters)				0.1741**		0.1964**	0.3986**	0.3998**	0.1989**
				(0.0310)		(0.0286)	(0.0712)	(0.0713)	(0.0279)
Tenure at current job (bw 2 and 3 quarters)				0.2695**		0.2863**	0.4594**	0.4617**	0.2908**
				(0.0323)		(0.0295)	(0.0721)	(0.0722)	(0.0288)
Tenure at current job (bw 3 and 4 quarters)				0.5224**		0.5126**	0.6601**	0.6633**	0.5153**
				(0.0314)		(0.0283)	(0.0709)	(0.0710)	(0.0276)
Tenure at current job (bw 4 and 5 quarters)				0.1725**		0.2523**	0.6445**	0.6472**	0.2749**
				(0.0412)		(0.0343)	(0.0734)	(0.0737)	(0.0330)
Tenure at current job (bw 5 and 6 quarters)				0.0170		0.2164**	0.7417**	0.7446**	0.2347**
				(0.0507)		(0.0387)	(0.0747)	(0.0749)	(0.0374)
Tenure at current job (bw 6 and 7 quarters)				0.1014*		0.1984**	0.6619**	0.6650**	0.2301**
				(0.0524)		(0.0429)	(0.0837)	(0.0840)	(0.0409)
Tenure at current job (bw 7 and 8 quarters)				0.2201**		0.3525**	0.8076**	0.8105**	0.3531**
				(0.0524)		(0.0424)	(0.0842)	(0.0844)	(0.0418)
Tenure at current job (more than 8 quarters)				-0.0189		0.1380**	0.6717**	0.6749**	0.1483**
				(0.0428)		(0.0350)	(0.0746)	(0.0748)	(0.0340)
Wage Deciles	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational Dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Organization Dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	77,084	77,084	77,084	77,084	114,455	114,455	47,162	47,162	124,252
Positions	6,428	6,428	6,428	6,428	8,681	8,681	3,069	3,069	9,497
Log Likelihood	-9,802	-9,786	-9,640	-9,472	-12,823	-12,651	-3,820	-3,683	-13,431

Notes: Asymptotic standard errors in parentheses. The standard errors are corrected for individual cluster effects. * Significant at 10% level. ** Significant at 5% level.

Table 7: Example of Probabilities of Promotions Conditional on the Number of Previous Promotions

Number of Previous	Probability of Promotion within		
	6 Months	1 Year	2 Years
0	0.169	0.455	0.861
1	0.087	0.243	0.455
2	0.078	0.220	0.412
3	0.086	0.240	0.450

Note: These probabilities are calculated using the monthly rates predicted in model 9, Table 6. The probabilities refer to a base group worker characterized by being a 25 years old single non-white male with incomplete college education and just incorporated at a median wage level position at the operations and distribution department at one of the organizations of the company during 1989.

Table 8: Probit Selected Cases for Monthly Promotion Rates - 1989/1994

Variables	Gender		Race		Education		Occupation	
	Men	Women	Whites	Non-Whites	Some College	Post-Degree	Operations/Distrib.	Finance
Constant	-1.9305**	-1.8941**	-1.6633**	-2.4219**	-2.4699**	-1.5791**	-1.0716**	-2.3243**
	(0.3521)	(0.2785)	(0.2341)	(0.3712)	(0.2900)	(0.5693)	(0.3180)	(0.4095)
Men			0.0687**	0.0344	0.0747**	-0.0341	0.2108**	0.0519
			(0.0216)	(0.0381)	(0.0351)	(0.0439)	(0.0439)	(0.0505)
Married	0.1356**	0.0187	0.0617**	0.0587	0.0572*	0.1497**	0.0323	0.0396
	(0.0277)	(0.0227)	(0.0199)	(0.0376)	(0.0303)	(0.0442)	(0.0401)	(0.0468)
White	0.1212**	0.0494*			0.0839**	0.1061**	0.1374**	0.0252
	(0.0320)	(0.0270)			(0.0341)	(0.0466)	(0.0476)	(0.0556)
Age (entry)	-0.0180	-0.0128	-0.0235**	0.0368**	0.0092	-0.0408	-0.0201	0.0042
	(0.0139)	(0.0103)	(0.0096)	(0.0187)	(0.0107)	(0.0269)	(0.0173)	(0.0219)
Age Squared (entry)	0.0001	0.0000	0.0001	-0.0007**	-0.0003*	0.0003	0.0001	-0.0003
	(0.0002)	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
College	0.1402**	0.1163**	0.1367**	0.1371**			0.1084**	0.1018
	(0.0370)	(0.0279)	(0.0248)	(0.0434)			(0.0470)	(0.0643)
Post-Degree	0.2444**	0.2290**	0.2466**	0.2279**			0.1593*	0.1095
	(0.0447)	(0.0437)	(0.0349)	(0.0620)			(0.0837)	(0.0979)
1 Previous Promotion	-0.2846**	-0.3048**	-0.2994**	-0.2497**	-0.2931**	-0.2990**	-0.3471**	-0.3129**
	(0.0292)	(0.0249)	(0.0209)	(0.0434)	(0.0335)	(0.0487)	(0.0421)	(0.0494)
2 or more Previous Promotions	-0.3165**	-0.3621**	-0.3340**	-0.2884**	-0.4370**	-0.3690**	-0.5689**	-0.2625**
	(0.0494)	(0.0532)	(0.0419)	(0.0778)	(0.0701)	(0.1081)	(0.1108)	(0.0866)
Tenure at current job (bw 1 and 2 quarters)	0.1894**	0.2138**	0.1957**	0.2173**	0.2277**	0.2715**	0.2405**	0.1738**
	(0.0437)	(0.0364)	(0.0319)	(0.0573)	(0.0438)	(0.0717)	(0.0576)	(0.0799)
Tenure at current job (bw 2 and 3 quarters)	0.2529**	0.3316**	0.3197**	0.1994**	0.2275**	0.4827**	0.2384**	0.3590**
	(0.0447)	(0.0379)	(0.0328)	(0.0604)	(0.0459)	(0.0731)	(0.0616)	(0.0775)
Tenure at current job (bw 3 and 4 quarters)	0.5288**	0.5260**	0.5358**	0.4734**	0.4473**	0.6928**	0.3858**	0.6950**
	(0.0423)	(0.0367)	(0.0314)	(0.0581)	(0.0457)	(0.0716)	(0.0623)	(0.0707)
Tenure at current job (bw 4 and 5 quarters)	0.2628**	0.3102**	0.3068**	0.1833**	0.0779	0.5505**	0.0268	0.4965**
	(0.0489)	(0.0449)	(0.0367)	(0.0747)	(0.0604)	(0.0825)	(0.0810)	(0.0892)
Tenure at current job (bw 5 and 6 quarters)	0.2821**	0.2162**	0.2499**	0.2071**	0.1362**	0.5077**	0.0782	0.3764**
	(0.0553)	(0.0513)	(0.0431)	(0.0754)	(0.0636)	(0.0913)	(0.0867)	(0.0972)
Tenure at current job (bw 6 and 7 quarters)	0.3401**	0.1470**	0.2588**	0.1664*	0.0477	0.6134**	0.0860	0.2883**
	(0.0593)	(0.0580)	(0.0464)	(0.0866)	(0.0759)	(0.0914)	(0.0939)	(0.1141)
Tenure at current job (bw 7 and 8 quarters)	0.4241**	0.3203**	0.3596**	0.3666**	0.1866**	0.6924**	0.1344	0.3626**
	(0.0618)	(0.0573)	(0.0481)	(0.0850)	(0.0743)	(0.0982)	(0.0988)	(0.1255)
Tenure at current job (more than 8 quarters)	0.2508**	0.1082**	0.1773**	0.0960	0.0089	0.5658**	-0.0535	0.3131**
	(0.0518)	(0.0453)	(0.0383)	(0.0728)	(0.0553)	(0.0860)	(0.0737)	(0.0925)
Wage Deciles	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational Dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Organization Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54,134	70,056	94,370	29,874	46,879	22,470	25,272	18,291
Positions	5,473	4,024	7,249	2,248	3,692	1,618	1,930	1,432
1 Prev.Prom = 2 Prev.Prom (p-value)	0.5241	0.2975	0.4117	0.6333	0.0450	0.5096	0.0456	0.5519

Notes: Asymptotic standard errors in parentheses. The standard errors are corrected for individual cluster effects. The pseudo r-squared is that proposed in McFadden (1974). * Significant at 10% level. ** Significant at 5% level.

Table 9: Probit Estimates for Monthly Promotion Rates for Non-Leavers

Variables	All Employees	Non-Leavers
Constant	-1.9885**	-1.8941**
	(0.2153)	(0.2785)
Men	0.0458**	0.0313
	(0.0187)	(0.0216)
Married	0.0610**	0.0552**
	(0.0173)	(0.0201)
White	0.0784**	0.1039**
	(0.0204)	(0.0238)
Age (entry)	-0.0115	-0.0116
	(0.0085)	(0.0099)
Age Squared (entry)	-0.0001	0.0000
	(0.0001)	(0.0001)
College	0.1357**	0.1118**
	(0.0219)	(0.0256)
Post-Degree	0.2418**	0.2194**
	(0.0299)	(0.0339)
1 Previous Promotion	-0.2794**	-0.3341**
	(0.0187)	(0.0207)
2 or more Previous Promotions	-0.3106**	-0.3476**
	(0.0365)	(0.0389)
Tenure at current job (bw 1 and 2 quarters)	0.1989**	0.1787**
	(0.0279)	(0.0325)
Tenure at current job (bw 2 and 3 quarters)	0.2908**	0.2708**
	(0.0289)	(0.0335)
Tenure at current job (bw 3 and 4 quarters)	0.5153**	0.4828**
	(0.0276)	(0.0321)
Tenure at current job (bw 4 and 5 quarters)	0.2749**	0.2554**
	(0.0330)	(0.0375)
Tenure at current job (bw 5 and 6 quarters)	0.2348**	0.2182**
	(0.0374)	(0.0422)
Tenure at current job (bw 6 and 7 quarters)	0.2301**	0.1754**
	(0.0409)	(0.0461)
Tenure at current job (bw 7 and 8 quarters)	0.3531**	0.3090**
	(0.0418)	(0.0470)
Tenure at current job (more than 8 quarters)	0.1483**	0.0958**
	(0.0340)	(0.0376)
Wage Deciles	Yes	Yes
Occupational Dummies	Yes	Yes
Organization Dummies	Yes	Yes
Year Dummies	Yes	Yes
Observations	124,252	90,005
Positions	9,497	6,465
1 Prev.Prom = 2 Prev.Prom (p-value)	0.3563	0.7325

Notes: Asymptotic standard errors in parentheses. The standard errors are corrected for individual cluster effects. * Significant at 10% level. ** Significant at 5% level.