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An Examination of Fast Tracks and Functional Area**

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## ABSTRACT

### **Promotion Determinants in Corporate Hierarchies: An Examination of Fast Tracks and Functional Area<sup>\*</sup>**

This article estimates a dynamic reduced-form model of intra-firm promotions using an employer-employee panel of over 300 of the largest corporations in the U.S. in the period from 1981 to 1988. The estimation conditions on unobserved individual heterogeneity and allows for both an endogenous initial condition and sample attrition linked to individual heterogeneity in demonstrating the relative importance of variables that influence promotion. The role of the executive's functional area in promotion is considered along with the existence and source of promotion fast tracks. We find that while the principal determinant of promotions is unobserved individual heterogeneity, functional area has a high explanatory power, resulting in promotion probabilities that differ by functional area for executives at the same reporting level and firm. No evidence is found that an executive's recent speed of advancement in pay grade has a causal impact on in- sample promotions after conditioning on the executive's career speed of advancement. For high-level executives, fast tracks appear to result from heterogeneity in persistent individual characteristics, not from an inherent benefit in recent advancement itself.

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# 1 Introduction

This paper considers the promotion of high-level American executives. A dynamic reduced-form model of promotion outcomes is estimated using an employer-employee panel of over 300 of the largest corporations in the U.S. in the period from 1981 to 1988. The model demonstrates the relative importance of variables that influence promotion, examines the existence and source of fast tracks in promotion while conditioning on unobserved individual heterogeneity in promotion and allowing for both an endogenous initial condition and sample attrition linked to individual heterogeneity. We also consider the role of the executive's functional area (accounting, marketing, etc.) in promotion.

This paper contributes to earlier investigations of promotion in the personnel economics literature and in the management literature. We corroborate findings on promotion regarding the effect of hierarchical level and the importance of unobserved heterogeneity in the personnel economics literature (Baker, Gibbs and Holmstrom, 1994a, 1994b, Lazear, 1992). Firm studies in both literatures find evidence of promotion fast tracks but do not empirically determine the source of fast tracks. By analyzing the role played by the speed of past advancement on promotion outcomes, we are able to evaluate implications from models of job assignment that regard whether the source of promotion fast tracks is simply superior worker ability (persistent unobserved individual heterogeneity to the researcher) or whether rapid promotion has its own positive causal impact on worker promotability due to the potential signal it reveals to the labor market of high worker ability. Findings on the potential signaling role of promotions are appearing in the personnel economics literature (DeVaro and Waldman 2012, Bognanno and Melero 2012). At the same time, investigating the impact that functional area may have on promotion outcomes contributes to the management science literature on this question (Vroom and MacCrimmon 1968, Forbes and Piercy 1991) and is of general interest.

One major finding in this paper is that, when promotion is defined as a change in job title resulting in a higher pay grade, the most influential determinant of promotion by far is unobserved individual heterogeneity. Determinants of less importance are functional area, career advancement speed (measured as the executive's inflation adjusted pay grade midpoint divided by the executive's age as of the executive's first appearance in the sample), human capital (age and education), firm variables (profits, sales and size),

tenure and newcomer status at the firm and reporting level in the firm. Rates of promotion diminish with advancement in level and age. Career advancement speed, on which unobserved individual heterogeneity is conditioned, has a positive effect on promotion probabilities but the recent speed of advancement has no significant effect. This indicates that fast-tracks in promotion result from heterogeneity in persistent individual characteristics and not from a causal effect that recent advancement might have if it reveals a signal to the outside labor market of high worker ability. Promotion probabilities are negatively correlated with sample attrition.<sup>1</sup> Overall, the promotion process can be characterized as a static discrete outcome model in which all serial correlation can be accounted for by persistent individual unobserved factors.

The next section of the paper discusses the economics literature on promotions. Section 3 contains a discussion of the data. Section 4 contains the empirical model and results are discussed in Section 5. Concluding remarks are found in section 6.

## 2 Promotions in the Economics Literature

Much of the influential work on firm hierarchies comes from single firm studies of personnel records that allow for a comprehensive examination of the internal workings of the firm. Key early papers include Baker, Gibbs and Holmstrom (here after BGH, 1994a, 1994b) and Lazear (1992). BGH examined twenty years of personnel data for all management employees of a single, medium-sized U.S. firm in a service industry. They relied on observed job transitions in the data to define levels within the firm. Since there were many lengthy careers with movement through numerous job titles, they were able to precisely identify the firm's hierarchical levels. Eight levels and seventeen primary job titles covered over 99% of management level employment.

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<sup>1</sup>This result is related to the findings of both Baker, Gibbs and Holmstrom (1994a) and Treble, van Gameren, Bridges and Barnby (2001) who document fast-track exit effects (those promoted more quickly having a higher exit rate from the firm). Our finding is contrary in flavor but not exactly the same for two reasons. First, we consider the correlation between the promotion probability and reporting in the sample, not the correlation between the ex post result of being promoted on firm exit. Second, individual attrition in these data occurs when the firm does not report information on an executive but does report on other executives. In this case, exit from the firm can either be caused by the worker leaving the firm (either voluntary or involuntary) or by the firm simply not reporting on an employed executive.

Underscoring the gains to promotion, BGH (1994b) found that levels alone explained about 70% of the variance in pay across employees in a given year. Their results regarding promotion included: evidence of fast tracks;<sup>2</sup> workers promoted quickly from low levels were promoted subsequently more quickly; the rate of promotion was higher at low levels in hierarchy;<sup>3</sup> promotion rates that fell with firm tenure; a positive correlation between rapid promotion and firm exit. BGH (1994b) found evidence of serial correlation in real wage growth for managers that persisted after accounting for observable differences between individuals. Observable characteristics explained only part of heterogeneity across managers. As greater wage growth was associated with a greater speed of promotion, BGH suggest that the presence of an unobserved variable, such as ability, drives both promotions and wage growth.

Lazear (1992) analyzed thirteen years of personnel records from a large manufacturing firm. Lazear's findings included that those who changed jobs tended to have higher starting pay upon hire and this also increased the likelihood of higher relative career pay. Hence, differences in starting pay well explained differences in career earnings between workers and made starting pay and the first job important. This account of promotions being persistently influenced by factors at the time of hire is suggestive of fast-tracks.

Lazear states that workers may be sorted into their initial job assignment on the basis of real differences between them (unobserved individual heterogeneity to the researcher) or on the basis of a first impression that nevertheless carries a career-long effect. This unanswered question regarding the source of career-long advantages enjoyed by some workers relates to explanations of promotion fast tracks in job assignment models under alternative assumptions and is considered in this paper. Promotion fast tracks can result from both differences between workers in innate ability and from the advantage gained through early initial promotion.<sup>4</sup>

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<sup>2</sup>Evidence for the existence of promotion fast tracks was found also in Ariga, Ohkusa and Brunello's (1999) study of a Japanese firm, in the Seltzer and Merrett's (2000) study of the Union Bank of Australia, in Treble, van Gameren, Bridges and Barnby's (2001) study of large British financial sector firm, in Gibbs and Hendriks's (2004) study of a large US corporation and by Rosenbaum (1979). Howard and Bray (1988) found that Bell System managers with more significant job challenges in their initial years of employment had greater advancement at year twenty.

<sup>3</sup>Evidence of higher rates of promotion in lower hierarchical levels was also noted in Treble, van Gameren, Bridges and Barnby (2001).

<sup>4</sup>We draw these implications from two classes of models: the case of full information (e.g., Gibbons and Waldman, 1999) and the case of asymmetric learning (e.g., Waldman,

One distinction made between models of job assignment is whether learning about worker ability is asymmetric. In job assignment models with asymmetric learning of worker ability, the current employer is fully informed and outside firms learn worker ability through the signal provided by observing the workers current and previous job assignments. Job assignment models with heterogeneous workers, assuming either full information or asymmetric learning, imply serial correlation in promotion outcomes (fast-tracks) due to differences in worker ability, with more able workers achieving promotion more rapidly. However, in models with asymmetric learning, past promotions also have an inherent effect on promotion outcomes after conditioning on worker ability. Higher wages must be paid to workers whose promotions signal high ability to outside firms. Since workers who have been rapidly promoted in the past have already been signaled to be of high ability, their subsequent promotion is less costly and, hence, speedy past promotions will have a positive causal effect on the probability of subsequent promotion. This implies that serial persistence in individual promotion histories may simultaneously result from both persistent unobserved heterogeneity and state dependence explained by past promotion outcomes. Stated differently, fast tracks may arise both because of differences in ability and because of the advantage given to fast climbers.

When fast tracks arise out of differences in ability, we call this a spurious fast track because rapid initial promotion provides no inherent advantage in subsequent promotion. The latter reason gives rise to what we call a causal fast track, promotions that come more quickly because of the speed of past promotions. Our empirical method will distinguish between these two potential sources of fast-tracks. Evidence of casual fast tracks supports the notion of promotion signaling in the job assignment models with asymmetric information.

This paper is related to a previous work (Belzil and Bognanno, 2010) that had a similar central focus. It developed an empirical model of the determinants of promotion given the executive's human capital, firm scale variables, the executive's promotion opportunities and reporting level, unmeasured individual and firm characteristics and the effect of the speed of the worker's past hierarchical advancement on the prospects for current advancement. The static model estimated found that the most influential factors explaining the probability of a promotion were unobserved heterogeneity, the executive's

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1984, and Bernhardt, 1995).

reporting level in the firm and the executive's promotion opportunities. A dynamic model of promotion examined the effects of the past speed of promotion on current promotion probabilities, after conditioning on unobserved heterogeneity. After conditioning on unobservable heterogeneity, the speed of past advancement in level negatively influenced subsequent advancement for most executives. For a minority of executives, past speed of advancement aided promotion (and a fast track was found) and was associated with executives at lower levels and with lesser human capital. The overall influence of the speed of past promotion on subsequent promotion was negligible.

There are four central improvements in this paper over the previous work of Belzil and Bognanno (2010). First, this paper includes an analysis of the role of functional area on promotion that was not examined previously and has received scant attention in the economics literature. Second, the prior paper employed advancement in reporting level towards the CEO position as the measure of promotion. In this paper, we use changes in job titles coupled with nominal pay grade midpoint increases to define promotion. We show that this new definition of promotion exhibits more power in explaining wages than the previous promotion measure. Linking promotion to changes in job title is also more standard in the literature and gives the results greater comparability. One difference between these alternative definitions is that the incidence of demotions is much lower with the job title/pay grade change definition. Consistent with the findings for the firm studied in BGH, demotions appear rare in U.S. corporate data. Third, the prior paper measured past speed of advancement in reporting level (employing the executive's reporting level, age and years of education to construct speed) to capture the speed of past promotion. Because advancement in level can vary in significance both within and across firms, the speed measure employed was not perfectly comparable across executives. This paper measures advancement speed as the speed of pay grade attainment (defined as the real pay grade midpoint divided by the worker's age) instead, a unit of measurement based on time and money that is universal across firms and workers. Last, there is significant attrition from the sample and to allow for the possibility that individual sample attrition is correlated with promotion probabilities, this paper models the response probability as a function of observed and unobserved individual heterogeneity.

### 3 Data

The proprietary panel data set used in this study provides information on over 30,000 executives working at over 300 of the largest firms in the United States during the period from 1981 to 1988. It was assembled by a major compensation consulting firm based on annual surveys completed by a human resource professional at the respondent company on both the company and individual executives. Respondent companies paid to participate in the survey, for which they received a report on the competitiveness of their pay levels relative to the pay levels of executives at comparable firms.<sup>5</sup>

The respondent company decided the number of executives to include each year and whether to participate annually or on a less frequent basis. The guidelines provided to firms suggested that they provide data on a representative sample of at least 75 executives in a variety of job families, managerial levels and organizational units. When a job title was shared by many executives and firms did not wish to report on each, they were asked to report on several representative cases. Respondent companies submitting data on more than 120 executives in a given year were subject to an additional fee. The mean number of executives reported on annually per firm was roughly 80.

The database reveals information on individual, job and firm characteristics, including: age, years of education, functional area, job title, firm tenure, base pay, bonus pay, reporting level, industry, firm profits, sales, and employment. Gender is not available in these data. The consulting firm took measures to ensure that the information for each individual and company was valid and complete. All survey data were run through a series of error checking programs and subsequently staff reviewed for follow up with the respondent company when inconsistencies were noted. The information submitted on firm characteristics was accompanied by the respondent company's most recent annual report and proxy statement to ensure the consistency of the financial data.

A unique identifier assigned to each individual allows them to be tracked over time in their given firm. However, the movement of an individual between firms cannot be tracked as they would be assigned a new identifier in the subsequent company. An individual's disappearance from these data

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<sup>5</sup>Published papers employing these data include Abowd (1990), Bognanno (2001) and Belzil and Bognanno (2008).

does not necessarily indicate an exit from the firm or a transition within the firm, as the respondent company elects which jobs to include each year.

Promotion can be defined in various ways. In these data, the basic decision is whether the basis for promotion should be changes in the reporting level, pay grade or job title. Firms have more job titles than pay grades and more pay grades than reporting levels and any of these metrics can change without necessarily causing a corresponding change in the others. As well, not everyone in a particular class (reporting level, pay grade or job title) will necessarily share the two alternative hierarchy measures with others in their firm and class.

Using the reporting level as a measure of promotion is easy since it is already ordered and was directly reported by the firms. In previous papers, we used changes in reporting level to define promotion. The disadvantage of reporting level is that it might change for those below the CEO if, for instance, the firm creates a new level in the reporting hierarchy by filling a previously nonexistent top level position. This does not constitute a demotion in the sense of falling to a lesser position for those below the new level, though adding a rung between an executive and the CEO may make the climb to the top longer. Level changes in the data appear to be a somewhat noisy measure and likely overstate the extent of demotions.

Using pay grade advancement to define promotion requires distinguishing the promotion-induced advance in an executive's pay grade midpoint from the normal annual advance in pay grade midpoints. Programming this distinction would be difficult. Simply coding as promotions cases in which an executive's pay grade midpoint advanced more than the firm mean pay grade advancement is not sufficient because pay grade midpoints do not always advance uniformly, sometimes the pay grades of higher level executives advance more in percentage terms.

In this paper, we use job title changes to define promotion. This measure has been widely used by others studying personnel data and enhances the comparability of our results. The drawback is that we assume that a person's status in an organization cannot change as long as the job title remains the same. Anecdotal evidence suggests that an executive's place in the pecking order and responsibilities in a firm may change even though the executive continues in the same job title. Overlooking this issue, job title changes must still be ordered on some basis to determine if they are promotions, lateral moves or demotions.

We define promotions as changes in job title that result in the execu-

tive being assigned a higher nominal pay grade midpoint. Lateral moves are defined as job title changes that result in the executive being assigned the same nominal pay grade midpoint. Demotions are defined as job title changes that result in the executive being assigned to a lower nominal pay grade midpoint. Non-movers have no change in their job title. Classifying transitions into these four types shows demotions to be rare, consistent with BGH. It is important to note that we are not defining promotions based on a job title change and an increase in the executive's actual base pay but rather an increase in the pay grade. A pay grade is the specified range in which a position's base salary may vary and is a typical aspect of corporate salary structures.

Table 1 provides basic summary statistics for the variables used in the likelihood estimations that are the next step in this paper. This table limits the sample to only executives who appear in the first and second years of the data (1981 and 1982). This accounts for sample size differences with other tables that do not impose this restriction. The intent of this is to show the extent of sample attrition and the progress in earnings for executives remaining in the data over the sample period. Means and standard deviations by year are provided for compensation, promotion rates and some firm variables. Means and standard deviations for executive characteristics in 1981 are also reported.

Table 2 considers the importance of reporting level and job title promotions in pay determination. Reporting level is measured as the number of reporting levels an executive is from the CEO (CEO= reporting level 1). The job title promotion index for purposes of this table is set to 0 in the first year an executive appears in the data and is updated by +1 for subsequent promotions and -1 for demotions. This gives it a structure similar to reporting level. Of course, reporting level identifies a layer in the hierarchy of the firm while the job title promotion index only indicates the movements up and down in job title without specifying the executive's position in the hierarchy. This is evident in the top panel of Table 2 that shows the reporting level to be more influential in pay determination. It should be noted that larger values for reporting level indicate being further from the top of the company. Hence, the coefficient on reporting level has a negative value. Executives one level closer to the CEO earn 23% more in total compensation (the sum of base and bonus pay). A one-unit rise in the promotion index increases pay by 13%.

The bottom panel of Table 2 includes individual fixed effects. The estima-

tion of the coefficient on reporting level is now based on executive's changing reporting levels in the data since the executive's mean pay over the sample is picked up in the individual intercept term. In this estimation, job title changes have a much larger impact on earnings than changes in reporting level. Job title changes are a better indicator of pay changes than changes in reporting level after accounting for worker fixed effects. This argues in favor considering job titles in defining promotion.

Table 3 provides pay changes and transitions between an executive's first and second years in the data, between the second and third years and between the third and fourth years with the changes grouped by the executive's initial transition between the first and second years. Between each executive's first two years in the data, 90% are non-movers, 8% are promoted, 1.2% are lateral movers and 0.7% are demoted. As might be expected, the percentage changes in the total compensation, base pay and bonus pay are largest for the promoted and smallest for the demoted (total compensation is merely the sum of the base pay and annual bonus and does not include other forms of compensation that might increase upon promotion).

Changes taking place in pay between an executive's second and third years and third and fourth years show that the beneficial effect of promotion over non-movement persists but is less evident in later years. Lateral movers, with higher rates of subsequent promotion, have the highest pay increases in years subsequent to the initial move. The lesser pay growth for the demoted persists but lessens in later years.

Changes taking place between an executive's second and third years in regards to transitions show that those who moved previously are more likely to have subsequent moves. Non-movers initially have about a 90% chance of remaining non-movers. Those with an initial change in job title combined with any type of movement in pay grade are substantially more likely to be promoted subsequently. The demoted are much more likely to be demoted again. Even in the year just following a promotion, the promoted executives have promotion probabilities about 75% greater than non-movers (13.8% versus 7.9%). This differential persists two years after promotion, initially promoted executives are 70% more likely than non-movers to be promoted between years three and four (15.1% versus 8.9%). The higher subsequent rate of promotion for those promoted between their first two years in the raw data is in accord with the notion of fast tracks, higher rates of subsequent promotion for those promoted previously. It's surprising that fast tracks appear evident even in regards to the in sample promotions in the very next

year for experienced executives occupying jobs at top reporting levels in the firm where longer tenure in position might be expected before another promotion.

Table 4 considers variables that might serve as leading indicators of promotion. Executives are grouped according to the transition they experience between their second and third year in the data. Transitions between the second and third years are used to allow pay changes to be constructed based on prior data (years one and two). The sample is restricted to executives present for at least three consecutive years. It is evident from the table that promoted executives received larger pay increases prior to promotion, followed by lateral movers and non-movers. The demoted between years two and three also received the smallest pay increases between years one and two.

Table 4 also shows that promoted executives tend to be younger and have less firm tenure prior to promotion. The promoted are followed in youth and inexperience by lateral movers and non-movers. These findings alone would say little about fast tracks since promotions are more frequent at the lower levels in the firm occupied by younger workers. However, promoted executives also tend to be younger than average among workers in their same job and firm prior to promotion. While the differences in age minus the firm/job mean age are small, less than a full year, this is consistent with the operation of fast tracks. Also consistent with fast tracks, the promoted spent the least time in their positions prior to promotion while the non-movers spent the most time. Differences between the groups in education are slight but orderly. The promoted are the most educated and the demoted are the least educated. All three classes of job title changers were likely to have had a prior job title change, particularly a previous promotion. Age, education, tenure and level are included in the formal empirical models of promotion to follow.

## 4 Econometric Model

We build a dynamic model of promotion in which the probability of promotion at a point in time is a function of individual and firm characteristics and the executive's career advancement speed. We model individual unobserved heterogeneity in a flexible way to account for persistent characteristics unobserved by the econometrician that affect promotions (like innate ability or

motivation).<sup>6</sup>

Our model addresses two important issues. The first one is the so called initial condition problem. The initial level at which the worker is observed in a firm is likely to be influenced by permanent unobserved factors that also affect the subsequent movement of the worker in the firm. We address this issue using Wooldridge’s (2005) method by conditioning on the distribution of unobserved heterogeneity on the initial level. The second issue concerns endogenous attrition. As shown in Table 1, a significant number of executives leave the sample each year. Dropping out of the sample at a point in time is caused either by the firm not participating in the survey at all or not reporting on an executive still with the firm or no longer with the firm. As mentioned in the data section, firms were asked to report on a representative sample of jobs, levels and units. In the case of job titles with multiple incumbents, several representative cases were requested. Job transitions might affect both the probability of the individual exiting the firm (a link between promotion and firm exits exists in the literature) and of being sampled in the case of continued employment (the likelihood of being sampled in the firm appears to rise at higher levels). For these reasons, sample attrition not due to firm non-participation is likely to be related to persistent individual factors that also affect promotion outcomes, making it endogenous. We therefore write the response probability (i.e. the probability that the worker is still present in the sample) as a function of the unobserved heterogeneity distribution and include the non-response probability in the individual’s contribution to the likelihood when the firm is participating in the survey but not reporting on a particular executive.

We turn now to a formal description of the model. We first describe the promotion probabilities and then turn to attrition and unobserved heterogeneity. Finally, we write the likelihood function that is estimated.

## 4.1 Promotion Probability

As already stated, the promotion indicator at year  $t$  is defined as a job title change associated with a higher nominal pay grade midpoint between the year  $t - 1$  and year  $t$ .

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<sup>6</sup>As already stated, movements of individuals across firms can not be identified. Therefore, we can not distinguish individual from firm persistent attributes. Without loss of generality, we refer to unobserved factors as individual specific.

The probability that individual  $i$ , belonging to firm  $j$  is promoted at year  $t$  is defined by the following equation:

$$\Pr(Y_{ijt} = 1) = \Lambda(\beta_r rmidage_{ijt-1} + \beta_q L_{qit-1} + \beta_{PO} PO_{ijt-1} + \beta_{F1} F_{jt-1} + \beta_{F2}(F_{jt} - F_{jt-1}) + \beta_U U_{t-1} + \alpha_i),$$

where:

- $\Lambda(\cdot)$  is the logistic cumulative distribution function.
- $rmidage_{ijt-1}$  is the real pay grade midpoint divided by the executive's age. This variable measures the career advancement speed including the impact of recent in-sample promotions.
- $L_{qit-1}$  is a set of binary variables indicating the reporting level of the executive in the firm. The value of the level, denoted  $q$ , is the number of reporting levels an executive is from the CEO position (level 1). Level 6 (or more) is the reference group and level 1 is not included because CEOs cannot be promoted internally.
- $PO_{ijt-1}$  measures the promotion opportunities in the firm. This variable is defined as the percentage of executives hired from outside the firm into positions above the given worker.
- $F_{jt}$  is a set of firm-specific variables. It includes profits, sales and total employment. The difference in these variables between periods  $t - 1$  and  $t$  is also included.
- $U_{t-1}$  is the national unemployment rate. This variable allows general labor market conditions to be taken into account. It is possible that the state of the labor market or the state of business cycle will have an influence on turnover, hiring and promotions even after controlling for firm profits, sales and employment.
- $\alpha_i$  is an individual specific term that represents individual unobserved heterogeneity. In order to resolve the initial condition problem, we specify its distribution conditional on the initial level (Wooldridge, 2005). Therefore, this term is decomposed into the sum of a regression component and an orthogonal unobserved component. More precisely, it takes the following form:

$$\alpha_i = \alpha_X X_{i0} + \alpha_r rmidage_{i0} + \alpha_U U_{iH} + \alpha_{FA} FA_{i0} + \tilde{\alpha}_i \quad (1)$$

where:

- $X_{i0}$  contains human capital variables (age, education and tenure) and an indicator for newcomer status in the firm. All of these variables are measured as of the individual’s first observation in the sample, that is before the first observable promotion occurs.
- $rmidage_{i0}$  is the real pay grade midpoint divided by the executive’s age also measured as of the executive’s first observation in the sample. It captures the executive’s prior career speed of advancement as of the start date in the sample. Including it allows the effect of the prior speed of advancement to be isolated from the effect of in-sample promotions to determine if in-sample promotions have a casual effect on subsequent promotion or whether fast tracks result only due to the greater prior career speed of advancement. In-sample promotions were shown to lead to a greater likelihood of subsequent promotion in the raw data.
- $U_{iH}$  is the yearly national unemployment rate measured at the time the executive was hired by the firm. This variable captures a potential long-lasting effect of labor market conditions when the individual entered the firm.
- $FA_{i0}$  is a set of binary variables indicating the functional area to which the executive belongs at the beginning of the sample period. Differences in promotability based on functional area have been found in the management literature.
- $\tilde{\alpha}_i$  is the orthogonal unobserved component; its distribution is defined more precisely below.

## 4.2 Response Probability

As noted previously, attrition for an executive is caused either by the firm not participating in the survey or by the firm participating but not reporting on the particular executive. In our framework, we consider attrition as endogenous only when it is due to the latter reason. Attrition due to firm non-participation in the survey is considered as exogenous and is not included in the contribution to the likelihood.

The response probability at each period is written as a function of individual characteristics (the same unobserved heterogeneity component as in

the promotion probability) and the variation of the number of executives reported by the firm from the previous period. More precisely, the probability that worker  $i$ , belonging to firm  $j$ , is observed at year  $t$  is determined by the following expression:

$$\Pr(Z_{ijt} = 1) = \Lambda(\delta_n \% \Delta nbobs_{jt} + \gamma_i),$$

where:

- $\% \Delta nbobs_{jt}$  is the relative variation of the number of workers reported by firm  $j$  between years  $t - 1$  and  $t$ .
- $\gamma_i$  is an individual specific term that represents individual unobserved heterogeneity. Its expression takes a form close to the one adopted for  $\alpha_i$ :

$$\gamma_i = \gamma_X X_{i0} + \gamma_r rmidage_{i0} + \gamma_U U_{iH} + \gamma_{FA} FA_{i0} + \tilde{\gamma}_i,$$

where  $X_{i0}$ ,  $rmidage_{i0}$ ,  $U_{iH}$  and  $FA_{i0}$  are the same set of variables as defined before, and  $\tilde{\gamma}_i$  is the orthogonal unobserved component.  $\tilde{\gamma}_i$  shares the same distribution as  $\tilde{\alpha}_i$ , which is defined below. Endogeneity of attrition is thus corrected by allowing the same unobserved individual specific factors to affect promotion and response probabilities.

### 4.3 Unobserved Heterogeneity

In order to minimize the impact of distributional assumptions needed to implement this model, we assume that  $\tilde{\alpha}_i$  and  $\tilde{\gamma}_i$  are characterized by an unknown cumulative distribution function,  $H(\cdot)$ , that is approximated using a discrete distribution (Heckman and Singer, 1984). The probability associated with type  $k$  is

$$p_k = \Pr(\tilde{\alpha}_i = \alpha_k, \tilde{\gamma}_i = \gamma_k),$$

where  $k = 1, \dots, K$ . The optimal number of types,  $K$ , is determined from the minimization of the Bayesian Information Criterion when the model is estimated with  $K$  ranging between 2 and 6. The type probability,  $p_k$ , is estimated using a logistic transform:

$$p_k = \frac{\exp q_k}{\sum_{s=1}^K \exp q_s} \quad k = 1, \dots, K,$$

where  $q_k$ s are parameters to be estimated with the restriction that  $q_K = 0$ .

## 4.4 Likelihood Function

For a given year, the individual's contribution to the likelihood is the product of the response probability and the promotion probability. When the worker leaves the sample, he contributes to the likelihood only if this non-reporting results from the firm's decision to not participate in the survey at all. Therefore, the likelihood for an individual  $i$  of type  $k$  who is observed during  $s$  periods,  $s = 1, \dots, 7$ , takes the following form:

$$L_i^s(k) = \prod_{t=1}^s [\Pr(Z_{ijt}(k) = 1) \cdot (\Pr(Y_{ijt}(k) = 1))^{d_{it}} \cdot (1 - \Pr(Y_{ijt}(k) = 1))^{1-d_{it}}] \cdot (1 - \Pr(Z_{ijs+1}(k) = 1))^{(att_i)}.$$

When the individual is only observed at the initial period and thus has no promotion observation,  $s = 0$ , the likelihood function appears as:

$$L_i^0(k) = (1 - \Pr(Z_{ij1}(k) = 1))^{(att_i)}$$

The variable  $d_{it}$  is an indicator taking the value 1 if the individual is observed at period  $t$  and  $att_i$  is the attrition indicator variable equal to 1 when the worker has no observation at period  $t$  and the firm is participating in the survey. Therefore, the likelihood of an individual of type  $k$  is the following:

$$L_i(k) = \prod_{s=0}^7 [(L_i^s(k))^{e_{is}}],$$

where  $e_{is}$  is an indicator variable taking the value 1 if the individual  $i$  is observed during  $s$  periods.

As a consequence, the mixed likelihood, for an individual  $i$ , is simply:

$$L_i = \sum_{k=1}^K p_k \cdot L_i(k).$$

The model is estimated by maximization of the sum of all individual (mixed) log likelihoods.

## 5 Empirical Results: The Determinants of Promotion

The first step of our analysis is devoted to the model specification in which we distinguish between the spurious and the causal fast-track effects. As

explained earlier, the distribution of unobserved heterogeneity includes a variable ( $rmidage_0$ ) that measures individual earnings achievements per year (real pay grade midpoint divided by age) as recorded when the individual enters the sample. This variable therefore captures the spurious fast-track effect whereas the variable ( $rmidage_t$ ), which measures past advancement up to year  $t$ , captures the causal fast-track effect.

We estimated several different versions of the model. These included specifications that modeled attrition and those that ignored the potential endogeneity of non-response. We also estimated both a static version of the model (with no causal fast-track) and a dynamic version. All versions were estimated with the unobserved heterogeneity distribution ranging from two to six types.

For brevity, we focus our presentation on the model that includes two types, which is the optimal number of types according to the Bayesian Information Criterion (values are provided in Table 5). Because virtually all models that incorporate an explicit modeling of non-response indicate a non-trivial degree of correlation between the unobserved heterogeneity component affecting non-response and the heterogeneity affecting promotions, we also focus on the model in which non-response (sample attrition) is endogenous.

The results are reported in three tables. The parameter estimates as well as their associated marginal effects on promotion probability are in Table 6. In Table 7, we report a variance decomposition of the promotion probability that allows the explanatory power of sets of variables to be examined (unobserved heterogeneity, in-sample career advancement speed, functional area, individual characteristics, reporting level, firm characteristics and the unemployment rate). Finally, in Table 8, we report measures of the correlation between the unobserved heterogeneity components explaining promotion and response and the correlation between promotion probability and response at period four. This allows the link between promotability and remaining in the sample (response) to be examined.

## 5.1 Investigating the Importance of Structural Fast-Tracks versus Unobserved Heterogeneity

The first striking result is the coexistence of the very weak negative effect of the in-sample career advancement speed on subsequent promotion (the structural fast-track) with the strong positive effect of the initially observed career

advancement speed in the initial condition equation on subsequent promotion (the spurious fast-track). The parameter estimate for the structural fast-track, -0.0763, implies that, after conditioning on unobserved heterogeneity, there is small negative effect on the promotion probability of -0.0029 for each 1,000 dollar gain in the pay grade midpoint per year.<sup>7</sup> However, the lifetime yearly gain in the pay grade midpoint measured at the start of the sample is the main component of the unobserved heterogeneity equation, with a parameter estimate of 0.5014, and a marginal effect that is more than six times greater. An increase in the average initial pay grade midpoint per year of \$1,000 increases the promotion probability by 0.019. In-sample promotions were associated with a substantial increase in the likelihood of subsequent promotion in the raw data. However, after conditioning on unobserved individual heterogeneity, there is no evidence that in-sample pay grade advancement increases subsequent promotion probabilities. This suggests that promotions, defined as a job change accompanied by an increase in the pay grade midpoint, in themselves do not have an inherent causal benefit on subsequent promotions, at least for relatively senior executives. It is possible that early career promotions could yet have a signaling aspect that would provide a benefit in subsequent promotions. Interestingly, in results available from the authors, in a model similar to the one presented but interacting in-sample pay grade advancement with reporting level, the interaction of in-sample advancement with the lowest reporting level examined (level 6) did have a positive and significant marginal effect on promotion probabilities. The interaction at reporting level 2 was negative and significant and the interactions between these levels were insignificant. The results for level 6 hint that an aspect of promotion signaling may exist at lower levels with younger workers. Overall, the results here strongly suggest that the source of widely noted executive fast tracks is unobserved individual factors, such as worker ability.

The standard human capital variables, such as age, education, and tenure, have a very limited impact on promotion. Education and firm tenure have a weak positive influence on promotion probabilities. Age and newcomer status have a weak negative effect. The marginal effects of age, newcomer status, education and tenure are -0.0013, -0.0068, 0.0014 and 0.0002 respectively.<sup>8</sup>

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<sup>7</sup>In comparison, Belzil and Bognanno 2010 reported a negative causal fast track effect for the majority of the population with an almost negligible magnitude.

<sup>8</sup>Howard and Bray (1988) found a college degree to be the best predictor of promotion. Forbes and Piercy (1991, p. 165) find that the time to the CEO position is reduced through

The parameter estimates on the levels in the firm indicate that promotion probabilities diminish at the more senior levels.

## 5.2 Labor Market Conditions

As mentioned earlier, our model takes into account the effect on promotion of both current labor market conditions and labor market conditions at the time the executive was hired. However, we find these measures have a minimal effect. The current rate of unemployment has a very slight dampening effect on promotion after accounting for firm profit, sales and employment. The marginal effect is -0.0016. The unemployment rate measured when the executive was hired has no significant effect.

## 5.3 Analysis of Functional Area

The potential role of functional area has received little empirical or theoretical attention in the economics literature. However, this topic has appeared in the management literature. Vroom and MacCrimmon (1968) found that promotion opportunities varied with functional area and were better in finance and marketing. Forbes and Piercy (1991) found that the functional area backgrounds of CEOs varied by industry and, with regards to the eventual CEOs, the time to reach various top positions in the organization varied by functional area. At the outset, it should be clear that our objective is not to treat functional area as an endogenous choice variable. We treat functional area as an element of the initial endogenous condition.

Our analysis is based on two possible interpretations. First, if firms assign individuals to functional areas based on skills and factors that are correlated with factors explaining promotability, we may expect the initial functional area to account for a non-trivial share of persistent unobserved heterogeneity. A second possibility, more in line with functional area having a causal effect, is that individuals move across different possible functional areas during their careers, targeting those areas that are known to provide better promotion opportunities. If so, the promotion process should display serial correlation, even after conditioning on unobserved heterogeneity.

Although we cannot distinguish between these two hypotheses, both of them imply that after some elapsed career duration, the prevailing functional

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higher levels of education. Useem and Karabel (1986) show the importance of earning a degree from an elite institution when the executive is not from elite social origins.

area of a given executive is likely to exhibit some correlation with subsequent promotion outcomes.

It is particularly interesting to note the degree of asymmetry in the effect and the level of significance of functional area indicators. The estimates indicate that those who work in marketing services, management areas and manufacturing seem to have a clear advantage in terms of future promotions. In terms of marginal effects, these estimates imply a higher annual promotion probability of 0.0177 for management, 0.016 for marketing and 0.0124 for manufacturing, relative to a material position (the reference functional area). The three weakest functional areas for promotion were employee relations, legal and management information systems. That differences in promotion probabilities by functional area exist came to light in the management literature and are confirmed here.

#### 5.4 Decomposing Promotion Probabilities

In order to assess the relative importance of each group of explanatory factors, we decompose the index function of the promotion probability. The explanatory power of each group of variables is measured by the  $R^2$  of the regression of the promotion index function on the given group of variables. Results reported in Table 7 show that 70.6% of the total variation in promotion probabilities is explained by persistent unobserved heterogeneity. The next most important set of variable, age, education, tenure, newcomer status in the firm and unemployment upon hire, accounts for 8.3%. The functional areas account for 5.4%. Firm variables (sales, profits and employment measured in levels and changes) and the indicator of promotion opportunities seem to have only a minimal explanatory power, as they explain only 3.3% of the variation. Initially observed career advancement speed accounts for 2.0%. Career advancement speed updated each sample year accounts for 1.6%. Reporting level and the in-sample unemployment rate each account for 0.5%. So, clearly, unobservable factors are much more influential than the factors that we are able to observe.

We also find a large correlation between the unobserved heterogeneity components of promotion outcomes and response probabilities in Table 8. The correlation is positive and equal to 0.467. This means that, *ceteris paribus*, those who are more likely to be promoted are also more likely to remain in the sample.

To summarize, the empirical evidence displayed in Tables 6, 7 and 8, as

well as results obtained from specifications that are not reported, suggest that the promotion process may be summarized by a static discrete outcome model, where all serial correlation is accounted for by persistent individual unobserved factors.

## 6 Conclusion

In this paper, we estimate a dynamic reduced-form model of promotions on a panel of high-level executives employed in over 300 U.S. corporations. Promotion is defined as a change in job title resulting in a higher pay grade midpoint. The promotion probability is written as a function of variables taken at their value when the individual is first observed in the sample, including observed individual characteristics (age, education, tenure, and newcomer status in the firm), the initially observed career advancement speed in pay grade, the unemployment rate and functional area, and variables that are updated each sample year, including career advancement speed, reporting level, firm characteristics and labor market conditions. The specification controls for unobserved individual heterogeneity and allows an endogenous initial condition and endogenous sample attrition.

Many studies in the personnel literature have found evidence of fast tracks. Executives observed being promoted quickly appear to have more rapid subsequent promotions. Evidence consistent with this notion was found here in a simple examination of the raw data in that executives with an in-sample promotion were more likely to receive a subsequent promotion. The cause of this phenomena has been hypothesized to result from the potential signaling effect of promotion but also simply from the persistent benefit of a promoted executive being of higher ability. No evidence is found in this paper that an executive's speed of advancement in pay grade updated each sample year has a positive causal impact on promotions after conditioning on the executive's past career speed of advancement. In fact, the in-sample career advancement speed has a weakly negative marginal effect on promotion. For high-level executives, fast tracks appear to result from heterogeneity in persistent individual characteristics, not from an inherent benefit in the recent advancement itself. Thus, the notion of fast tracks resulting from the persistent benefit of being of high ability is supported over the notion that fast tracks result from the signaling effect of promotions.

The large majority of the variation in promotion probabilities is explained

by persistent unobserved individual heterogeneity, about 71%. All observable variables combined, including age, education, tenure, functional area, reporting level, the unemployment rate and firm profits, sales and employment, account for just over 20% of the variation in promotion probabilities. This would make predicting promotion purely on the basis of observable characteristics for senior executives difficult. It is impossible to know the extent to which richer information is known within the firm that would make promotion predictions easier to make. Uncertainty in regards to promotion may serve the firm's interests if promotion tournament incentives are beneficial.

The management literature noted long ago that differences in promotion existed across functional areas. Our results support this finding. Promotion probabilities differ by functional area for executives at the same reporting level and firm. Executives initially observed in marketing, management and manufacturing had higher annual promotion probabilities. Those in employee relations, legal and management information systems had lesser annual promotion probabilities. The differences in promotion probabilities by functional area were evident even after controlling for observable individual characteristics. The different functional areas as a group account for about 5% of the variation in promotion probabilities.

In terms of future research, along the lines of the work of DeVaro and Waldman (2012), it would be interesting to see if the wage change upon promotion is the largest for those workers who appear *ex ante* to be the least likely to be promoted. Theoretically, a promotion in these cases should send the strongest signal to the outside labor market and force the largest wage increase from the current firm.

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## Tables

**Table 1:** Summary Statistics of the Sample Used in the Estimations

<b>Year</b>	1981	1982	1983	1984	1985	1986	1987	1988
<b>Individuals</b>	13,113	13,113	8,728	6,280	4,400	2,864	2,053	1,435
<b>Compensation Variables</b>								
Total Compensation (units of 10,000 1980USD)	7.8 (6.9)	8.1 (7.2)	8.5 (7.3)	9.4 (8.2)	10.2 (9.3)	10.6 (9.8)	11.7 (11.3)	12.9 (12.5)
Mean Base Pay (units of 10,000 1980USD)	6.2 (4.3)	6.4 (4.5)	6.9 (4.9)	7.4 (5.3)	7.8 (5.8)	8.1 (6.1)	8.6 (6.3)	9.3 (7.0)
Mean Bonus (units of 10,000 1980USD)	1.6 (3.0)	1.7 (3.1)	1.6 (2.8)	2.0 (3.4)	2.4 (4.1)	2.5 (4.2)	3.2 (5.8)	3.6 (6.0)
<b>Changes in Firm Variables and Promotion Rates</b>								
% $\Delta$ sales		2.9% (22%)	2.1% (44%)	0.1% (15%)	7.3% (13%)	-0.5% (26%)	10.2% (101%)	5.3% (11%)
% $\Delta$ profits		11% (88%)	28% (610%)	46% (291%)	84% (422%)	60% (915%)	-3% (252%)	143% (812%)
% $\Delta$ employment		2.1% (19%)	1.5% (36%)	0.1% (13%)	4.4% (19%)	1.2% (19%)	5.7% (79%)	1.8% (14%)
Annual Mean Promotion*		0.09 (0.28)	0.08 (0.27)	0.09 (0.28)	0.10 (0.30)	0.10 (0.30)	0.08 (0.27)	0.07 (0.26)
<b>Executive Characteristics in 1981</b>								
Firm Tenure	15.1	(10.5)						
Reporting Level	4.3	(1.4)						
Years in Position	4.0	(3.9)						
Age	47.4	(8.7)						
Education	16.2	(1.9)						

\* The promotion indicator takes the value 1 if the executive experiences a change in job title associated with a higher pay grade midpoint, 0 if not.

**Table 2:** Level versus Job Title in Pay Determination

<b>OLS</b>				
Dependent Variable	ln (Total Compensation)		ln (Base Pay)	
Intercept	12.08***	(0.005)	11.78***	(0.004)
Job Title Promotion Index	0.13***	(0.004)	0.10***	(0.003)
Reporting Level	-0.23***	(0.001)	-0.20***	(0.001)
N	107,359		107,359	
$R^2$	0.30		0.31	
<b>Individual Fixed Effects</b>				
Dependent Variable	ln (Total Compensation)		ln (Base Pay)	
Job Title Promotion Index	0.15***	(0.001)	0.13***	(0.001)
Reporting Level	-0.02***	(0.001)	-0.02***	(0.001)
N	107,359		107,359	
$R^2$	0.97		0.98	

Note 1: The job title promotion index is set to 0 in the first year an executive appears in the data and is updated by +1 for subsequent promotions and -1 for demotions.

Note 2: Standard errors under parenthesis. Significance levels: \*\*\* 1%; \*\* 5%; \* 10%.

**Table 3:** Pay and Transition Outcomes Subsequent to Initial Transition

<b>Transition between years 1 and 2</b>	Non-Mover	Promoted	Lateral Mover	Demoted
<b>Transition Definition</b>	Same job title	New job title & higher nominal pay grade	New job title & same nominal pay grade	New job title & lower nominal pay grade
% of sample	90.1%	8.0%	1.2%	0.7%
<b>Δ Years 1 and 2: Initial Pay Changes and Transitions</b>				
%ΔTotal Compensation	5.4%	11.4%	7.0%	2.9%
%ΔBase Pay	3.2%	9.2%	5.2%	1.6%
%ΔBonus	23.7%	28.1%	14.3%	3.1%
%ΔPay Grade Midpoint	8.1%	19.2%	0.0%	-10.0%
Non-Mover	100.0%			
Promoted		100.0%		
Lateral Mover			100.0%	
Demoted				100.0%
N (total=28,162)	25,380	2,247	348	187
<b>Δ Years 2 and 3: Subsequent Pay Changes and Transitions by Initial Transition Outcome</b>				
%ΔTotal Compensation	3.8%	6.7%	7.0%	3.3%
%ΔBase Pay	4.4%	5.4%	5.9%	4.0%
%ΔBonus	10.0%	19.5%	28.0%	0.0%
%ΔPay Grade Midpoint	6.9%	7.1%	12.9%	19.5%
Non-Mover	89.8%	81.1%	77.6%	81.5%
Promoted	7.9%	13.8%	17.1%	16.7%
Lateral Mover	1.6%	3.5%	3.3%	0.0%
Demoted	0.8%	1.7%	1.9%	13.5%
N (total=17,954)	16,126	1,510	210	108
<b>Δ Years 3 and 4: Subsequent Pay Changes and Transitions by Initial Transition Outcome</b>				
%ΔTotal Compensation	6.8%	8.3%	9.2%	5.3%
%ΔBase Pay	4.4%	5.7%	5.5%	3.0%
%ΔBonus	26.7%	29.4%	18.1%	6.5%
%ΔPay Grade Midpoint	7.3%	9.1%	9.3%	10.7%
Non-Mover	89.4%	82.0%	72.4%	78.8%
Promoted	8.9%	15.1%	18.1%	19.7%
Lateral Mover	0.9%	1.6%	5.2%	1.5%
Demoted	0.7%	1.3%	4.3%	0.0%
N (total=12,164)	10,942	1,040	116	66

**Table 4:** Potential Leading Indicators of Promotion: Prior Pay, Human Capital and Transitions

<b>Transition between Years 2 and 3</b>	Non-Mover	Promoted	Lateral Mover	Demoted
<b>Transition Definition</b>	Same job title	New job title & higher nominal pay grade	New job title & same nominal pay grade	New job title & lower nominal pay grade
% of sample	88.9%	8.5%	1.8%	0.9%
N (total=17,954)	15,957	1,529	315	153
<b>Δ Years 1 and 2: Compensation Variables</b>				
%ΔTotal Compensation	6.3%	8.4%	7.0%	5.4%
ΔTotal Compensation	\$4,460	\$6,342	\$4,860	\$5,472
%ΔBase Pay	4.0%	5.4%	3.5%	3.2%
ΔBase Pay	\$2,414	\$3,465	\$1,894	\$2,435
%ΔBonus	26.6%	24.6%	34.0%	20.7%
ΔBonus	\$2,045	\$2,877	\$2,966	\$3,036
%ΔPay Grade Midpoint	9.0%	9.9%	10.7%	11.0%
ΔPay Grade Midpoint	\$6,588	\$7,438	\$7,617	\$9,857
<b>Year 2: Compensation Variables Minus Mean for Firm, Year, Job Title</b>				
Total Comp – Job Mean	\$410	\$1,178	\$3,126	\$2,781
Base Pay – Job Mean	\$93	\$596	\$1,053	\$2,167
Bonus – Job Mean	\$342	\$653	\$2,073	\$614
Base – Grade Midpoint*	-\$1,553	-\$1,121	-\$2,389	-\$5,642
<b>Year 2: Human Capital Variables</b>				
Age	47.3	44.8	46.7	48.3
Age – Job Mean	-0.04	-0.80	-0.30	-0.14
Years in Position(inpost)	4.1	2.9	3.0	3.1
Inpost – Job Mean	-0.02	-0.26	-0.07	-0.11
Age – Education – 5	25.9	23.3	25.3	27.0
Tenure	14.8	13.2	14.4	15.2
Education	16.4	16.5	16.4	16.3
Reporting Level:1=CEO	4.3	4.3	4.2	4.0
<b>Prior Transition between Years 1 and 2</b>				
Non-Mover	90.8%	82.9%	81.0%	79.7%
Promoted	7.7%	13.6%	16.8%	16.3%
Lateral Mover	1.0%	2.4%	2.2%	2.6%
Demoted	0.6%	1.2%	0.0%	1.3%

\* Only 43% of executives receive base pay at or above their real pay grade midpoint.

**Table 5:** Bayesian Information Criterion Values for Model Selection

	$\log(L)$	BIC
1 type	-58,411.93	11,7299.92
2 types	-58,324.39	11,7155.89
3 types	-58,315.47	11,7169.09
4 types	-58,315.01	11,7199.21
5 types	-58,314.67	11,7229.59
6 types	-58,314.15	11,7259.59

**Table 6:** Parameter Estimates and Marginal Effects

	Parameters (S.E.)	Marginal effects (S.E.)
<b>Unobserved heterogeneity distribution parameters</b>		
$q_1$	1.1406*** (0.1451)	-
<b>Promotion probability</b>		
<i>Time-invariant unobserved heterogeneity</i>		
Intercept type 1 ( $\tilde{\alpha}_1$ )	-2.4256*** (0.0845)	-
Intercept type 2 ( $\tilde{\alpha}_2$ )	-0.8487*** (0.0716)	-
<i>Executive's time-invariant observed characteristics</i>		
Age	-0.3376*** (0.0144)	-0.0013*** (0.0001)
Education	0.3693*** (0.0412)	0.0014*** (0.0002)
Tenure	0.0397*** (0.0089)	0.0002*** (0.0000)
New comer	-0.1949*** (0.0542)	-0.0068*** (0.0018)
Initially observed career advancement speed (in \$1,000s)	0.5014*** (0.0395)	0.0190*** (0.0021)
Unemployment rate at hiring	-0.0047 (0.0064)	-0.0002 (0.0002)
Functional area:		
Legal	-0.2638*** (0.0426)	-0.0089*** (0.0014)
Employee relations	-0.3177*** (0.0415)	-0.0104*** (0.0014)
Manufacturing	0.2854*** (0.0330)	0.0124*** (0.0019)
Marketing	0.3563*** (0.0330)	0.0160*** (0.0020)
Finance	-0.0348* (0.0190)	-0.0013* (0.0007)
Management info systems	-0.2345*** (0.0537)	-0.0080*** (0.0018)
Research / engineering	0.1390*** (0.0342)	0.0056*** (0.0015)
Public / government relations	-0.0029 (0.0413)	-0.0001 (0.0016)
General management	0.3883*** (0.0557)	0.0177*** (0.0033)
Material, purchasing, warehousing	ref.	ref.
Career advancement speed updated each sample year (in \$1,000s)	-0.0763** (0.0318)	-0.0029** (0.0013)
Level in the firm		
Level 2	-0.3716*** (0.0378)	-0.0119*** (0.0014)

Continued on next page

**Table 6:** Continued

	Parameters (S.E.)	Marginal effects (S.E.)
Level 3	-0.1078*** (0.0216)	-0.0039*** (0.0007)
Level 4	0.1092*** (0.0168)	0.0039*** (0.0007)
Level 5	0.0863*** (0.0202)	0.0034*** (0.0009)
Level 6	ref.	ref.
<i>Firm characteristics</i>		
Promotion opportunities	0.1723*** (0.0062)	0.0068*** (0.0006)
Sales (in \$1M)	-0.0164*** (0.0055)	-0.0006*** (0.0002)
% $\Delta$ sales	-0.0008 (0.0007)	0.0000 (0.0000)
Profit (in \$10,000)	0.0004 (0.0010)	0.0000 (0.0000)
$\Delta$ profit (in \$10,000)	0.0032** (0.0013)	0.0001** (0.0000)
Employment (in 10,000)	-0.0288*** (0.0044)	-0.0011*** (0.0002)
% $\Delta$ employment	0.0030*** (0.0008)	0.0001*** (0.0000)
<i>Labor market conditions</i>		
Unemployment rate	-0.0430*** (0.0093)	-0.0016*** (0.0003)
<b>Response probability</b>		
<i>Time-invariant unobserved heterogeneity</i>		
Intercept type 1 ( $\tilde{\gamma}_1$ )	1.3986*** (0.0778)	-
Intercept type 2 ( $\tilde{\gamma}_2$ )	1.7063*** (0.0858)	-
<i>Executive's time-invariant observed characteristics</i>		
Age	-0.0616*** (0.0084)	-0.0011*** (0.0002)
Education	0.1219*** (0.0289)	0.0022*** (0.0005)
Tenure	0.0119 (0.0073)	0.0002 (0.0001)
New comer	-0.0268 (0.0347)	-0.0048 (0.0062)
Initially observed career advancement speed (in \$1,000s)	0.1963*** (0.0123)	0.0347*** (0.0022)
Unemployment rate at hiring	-0.0506*** (0.0035)	-0.0089*** (0.0006)
Functional area:		
Legal	0.3254*** (0.0390)	0.0524*** (0.0058)
Employee relations	0.0376* (0.0195)	0.0066* (0.0034)

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**Table 6:** Continued

	Parameters (S.E.)	Marginal effects (S.E.)
Manufacturing	-0.1243*** (0.0199)	-0.0227*** (0.0037)
Marketing	-0.3413*** (0.0205)	-0.0658*** (0.0042)
Finance	0.0966*** (0.0138)	0.0175*** (0.0025)
Management info systems	-0.2317*** (0.0295)	-0.0435*** (0.0058)
Research / engineering	-0.1732*** (0.0253)	-0.0320*** (0.0049)
Public / government relations	0.1317*** (0.0363)	0.0224*** (0.0059)
General management	-0.2242*** (0.0400)	-0.0420*** (0.0079)
Material, purchasing, warehousing	ref.	ref.
<i>Firm characteristics</i>		
% $\Delta$ nobs	-0.0138*** (0.0003)	-0.0024*** (0.0001)
Individuals	29,453	
Mean log-likelihood	-1.868	

Note 1: Marginal effects are computed at the means and modes of covariates, for type 1s.

Note 2: Significance levels: \*\*\* 1%; \*\* 5%; \* 10%.

**Table 7:** Variance Decomposition of the Promotion Probability

Time-invariant unobserved heterogeneity	0.706
Initially observed career advancement speed (in \$1,000s)	0.020
Functional area	0.054
Age, education, tenure, new comer status, unemployment at time of hire	0.083
Career advancement speed updated each sample year	0.016
Reporting level in the firm	0.005
Firm characteristics	0.033
Unemployment rate	0.005
<b>All variables</b>	<b>0.907</b>

Note 1: The variance decomposition is performed on all individuals observed at period 4.

Note 2: The share of the variance explained by each factor is measured by the  $R^2$  of the predicted promotion probability regressed on the variables associated to the factor.

**Table 8:** Correlation Between Promotability and Response

$\text{corr}(\alpha_i, \gamma_i)$	0.467
$\text{corr}(\text{Pr}(Y_{ij4} = 1), \text{Pr}(Z_{ij4} = 1))$	0.268

Note: The first line corresponds to the coefficient of correlation between the executive's time-invariant specific (unobserved and observed) components of promotion and response probabilities. The second line corresponds to the coefficient of correlation between the probabilities of promotion and response at period 4.