LATERAL MOVES, PROMOTIONS, AND TASK-SPECIFIC HUMAN CAPITAL:

THEORY AND EVIDENCE

by

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ABSTRACT

This paper studies the link between lateral mobility and promotions. The first part of the paper extends the theoretical literature by incorporating lateral moves, i.e., moves between jobs at the same job level, into a job assignment model with task-specific human capital accumulation. Lateral moves help workers acquire different types of task skills so that, if upper level jobs use task skills from multiple lower level jobs, then a laterally moved worker will become more productive after a promotion. The model thus predicts that workers who are laterally moved in one period are more likely to be subsequently promoted and experience high wage growth compared to workers who are not laterally moved. In addition, workers with very high levels of education are less likely to be laterally moved compared to workers with lower levels of education. We test the model's predictions using a large employer-employee linked panel dataset on senior managers in a sample of large US firms during the period 1981 to 1985. Our findings support the theoretical predictions and show the importance of lateral mobility in wage and promotion dynamics.

Keywords: lateral moves, task-specific human capital, promotions

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I. INTRODUCTION

Most studies of careers inside firms focus on worker movements across different job levels, i.e., promotions (see, for example, Rosen 1982; Prendergast 1993; and Gibbons and Waldman 1999). However, there is substantial evidence that suggests that lateral mobility, i.e., movements between jobs at the same job level, is very common. For example, Saari et al. (1988) survey 1,000 randomly selected firms in the US and find that over 40 percent of the organizations use horizontal moves in their human resource practices. Another example comes from General Electric's most recent succession saga. By the time Jack Welch left the CEO's office in 2001, the firm had 12 line departments under the Corporate Executive Office. The current Chairman and CEO, Jeffrey Immelt, served leadership roles in GE Medical, Plastics, and Appliances before becoming the CEO.

These examples suggest that not only are lateral moves important, but that there is an important link between lateral moves and promotions. In this paper we explore how lateral moves relate to promotions, wage dynamics, and education. To address these issues we incorporate lateral moves into a job assignment model characterized by task-specific human capital accumulation. In Gibbons and Waldman (2004) task-specific human capital refers to the idea that jobs consist of a bundle of tasks and through learning-by-doing a worker becomes more proficient at the tasks associated with any particular job as the worker gains experience on that job.[1] For example, the head of marketing has extensive knowledge about advertising and consumer behavior, while the head of logistics is an expert on supplier behavior. However, each manager may have little knowledge about the other's area although they work in the same firm. That is, employees' knowledge and skills are attached to their jobs and daily routines.

In this study we explore how task-specific skills play a role in workers' career development. The main argument is that lateral moves allow workers to acquire different types

[1] Gibbons and Waldman (2004) popularized the use of the term task-specific human capital to capture this idea. But the basic idea goes back much further and, in fact, Adam Smith's discussion of the pin factory can be thought of as an early discussion of the task-specific human capital concept. For other theory and empirical papers focused on task-specific human capital see, for example, Gibbons and Waldman (2006), Gathmann and Schoenberg (2010), Kellogg (2011), Schulz, Chowdhury, and Van de Voort (2013), and Delfgaauw and Swank (2016).

of task-specific human capital which makes them more productive if they are subsequently promoted. We first construct and analyze a theoretical model based on this idea and derive a set of predictions regarding the relationship between lateral moves and career outcomes. We then test the model's predictions using a large employer-employee linked panel dataset of US managers where we find empirical support for these predictions.

We consider a three-period model in which firms have job ladders consisting of two levels. Workers on the upper level job (e.g., the Chief Operating Officers) oversee workers on two distinct lower level jobs (e.g., division managers in marketing and logistics). We allow lateral moves between the two lower level jobs as well as vertical moves, i.e., promotions, from the lower level job to the upper level. The upper level job utilizes task skills from each of the lower level jobs (e.g., having both marketing and logistic skills makes a Chief Operating Officer more productive). Those task skills can be acquired either through working on the different lower level jobs or through formal education.[2] The accumulation of human capital is task specific and follows diminishing marginal returns to task-tenure on each lower level job.

The market is perfectly competitive with free entry of identical firms. An individual's education has two components: an education level (i.e., years of schooling) and an education type (i.e., major). When an individual enters the labor market, firms observe her education level and type but not her innate ability. Firms then learn about the individual's innate ability by observing her output in the first period which is assumed to be publicly observable. We further assume that innate ability and human capital are complementary in the production process while education and job tenure are substitutes in the human capital accumulation process.[3]

[2] Numerous surveys and studies support the idea that upper level jobs use a wider set of skills than lower level jobs. For example, according to the Occupational Information Network (O*NET), one of the most comprehensive surveys of occupation and job characteristics in the US, there are 17 core tasks for Chief Executives while only five core tasks for Financial Managers at the branch or department level. Mintzberg (1973) in an earlier study showed that managers perform a variety of different tasks, while London (1985) argued that lateral moves are effective for developing managers into "generalists". Ferreira and Sah (2012) provide a rationale for a productive advantage for workers with a broad set of skills in upper level jobs. They argue that, because "generalists" can facilitate communication among "specialists", an increasing breadth of expertise with job level minimizes communication costs.

[3] Numerous empirical studies find results consistent with ability and human capital being complementary in the production process. For example, Bartel and Sicherman (1998) reported a positive relationship between training and

The main trade-off captured by our model is that there are both benefits and costs associated with lateral moves. To see the logic, consider a firm with a Chief Operating Officer (COO) and a single division manager in each of marketing and logistics. Since knowledge of both marketing and logistics makes an individual in the COO position more productive, there is an advantage of having a COO with some previous experience in both the marketing and logistics divisions. The benefit of lateral moves therefore lies in the idea that upper level jobs use a wide but not necessarily deep set of skills, so a lateral move today will make the worker more productive in the future if the worker is promoted.

However, not everyone is laterally moved because there is a cost in terms of current output due to task-specific human capital. When task-specific human capital is important, an individual cannot fully utilize the skills that she acquires in one job when she is moved to another. The cost of a lateral move is lower productivity immediately after the move because the worker's current stock of human capital is less effective. As a result, only individuals who show potential for eventual promotion to the COO position are laterally moved. Further, because in our specification a higher education level increases the immediate cost of a lateral move, firms have no incentive to laterally move workers with very high education levels.

Our model yields three testable predictions. First, laterally moved individuals have higher promotion probabilities than workers who do not move both because laterally moved individuals have higher expected innate ability and because they have a more diverse set of skills which is valuable in the upper level job. Second, laterally moved individuals experience larger compensation growth on average after the move. The logic here is that there is an immediate cost associated with the move, so it is only beneficial when it contributes substantially to future productivity growth which translates into high future compensation growth. Third, individuals with very high levels of education are less likely to be laterally moved because of the effect of education on the immediate cost of a lateral move.

AFQT scores using the National Longitudinal Survey of Youth, while Acemoglu and Pischke (1998) found a similar pattern using German data.

To test these predictions we use an employer-employee linked panel dataset that contains data for the time period 1981 to 1985 on senior managers in a sample of large US firms. Since the seminal work of Baker, Gibbs, and Holmstrom (1994a,b), most of the empirical studies concerning wage and promotion dynamics, especially studies that employ US data, use a single firm's personnel records.[4] Multi-firm analyses in this area primarily rely on European data (e.g., Devereux et al. 2013; Frederiksen and Kato 2014). Our study uses a US multi-firm dataset that generates empirical findings that support the model's predictions. We find positive relationships between lateral moves and promotions and lateral moves and subsequent wage growth. We also find that workers with more than 18 years of education have a lower frequency of lateral moves.

This study contributes to the literature in multiple ways. First, it extends the theoretical literature on wage and promotion dynamics inside firms by formalizing the relationship between lateral moves and subsequent promotions. Second, the study contributes to the human capital literature by exploring the mechanism through which workers accumulate task-specific human capital during their careers. Third, the paper complements the recent work of Lazear (2012) and Frederiksen and Kato (2014) that focus on the types of education and early career movements that lead to corporate leadership positions later in careers. It also adds to the discussion of the extent to which formal education and learning-by-doing are substitutes in human capital development. Further, the study enriches the empirical literature on wage and promotion dynamics by providing empirical evidence on a set of new testable predictions concerning the relationship between lateral moves, promotions, compensation growth, and education using a multi-firm dataset on senior managers in large US corporations.

The outline for the paper is as follows. Section II reviews the related literature. Section III presents a three-period model of lateral moves and derives testable implications. Section IV provides empirical tests of the model's predictions. Section V discusses possible alternative explanations for our empirical findings. Section VI presents concluding remarks.

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[4] See Waldman (2013) for a survey that discusses this literature.

II. RELATED LITERATURE

Most of the theoretical literature on wage and promotion dynamics inside firms focuses on how individuals move along job ladders vertically. Two of the building block theoretical models concerning vertical career movements are the tournament model (e.g., Lazear and Rosen 1981; Rosen 1986) and the job assignment model (e.g., Gibbons and Waldman 1999). Both types of models assume only one type of job at each level and lateral moves are not considered.[5]

There are a few previous studies that consider lateral moves where most of those focus on either job rotation schemes or lateral moves that include a promotion. In a typical job rotation scheme, the firm chooses a select group of newly hired workers to follow a predetermined career path in which the workers move across a variety of jobs over the first few years of employment at the firm. Ortega (2001) develops a model in which job rotation facilitates the firm's learning about workers' job specific match values, while Li and Tian (2013) build on this idea to show how job rotation schemes can be used by larger firms to improve matches which in turn results in higher wages and lower turnover rates. There are also a number of papers that investigate lateral moves that include a promotion (see Kusunoki and Munagani 1998; Ariga 2006; and Sasaki et al. 2012). The lateral transfers focused on in those studies are different than the moves studied here since our focus is horizontal moves that do not include a promotion.

Friebel and Raith (2014) is a recent paper that is closer to ours in that it considers lateral moves that do not include a promotion. The focus of their paper is agency problems and how those agency problems interact with job assignment efficiency. They show that contracts that allow for lateral moves dominate contracts without such moves when each manager has private information about the workers in the manager's own division and correct job assignment is important for division profitability. Notice that neither this paper nor the papers described directly above capture the main idea we explore which is that lateral moves affect a worker's

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[5] To be precise, Lazear and Rosen (1981) do not model a post-promotion production process but numerous extensions of that classic model such as Rosen (1986) extend the analysis to allow for production after promotion takes place. But, as indicated, in this literature there is typically a single job on each level of the job ladder so there is no possibility for lateral moves.

human capital development and can thus be used as a way of improving the productivity associated with the promotion process.

There are two studies that consider lateral moves that are more closely related to our analysis. Gittings (2012) employs the same dataset we use and shows that individuals who are laterally moved earn higher wages in the lateral move period. But he does not provide a theoretical explanation for this finding and he also does not connect lateral moves to the promotion process. Clemens (2012) develops a theoretical model in which lateral transfers into a "fast" job are positively correlated with subsequent promotions while transfers into a "slow" job are negatively correlated with subsequent promotions.[6] However, using a single firm's personnel records, Clemens finds that lateral transfers into both fast and slow jobs are positively correlated with subsequent promotions. That is, he finds evidence more consistent with our model's predictions than those of his own theory concerning the effects of lateral moves.

This study is also related to recent developments in the human capital literature. In particular, we employ the approach of task-specific human capital presented in Gibbons and Waldman (2004; 2006) rather than the traditional dichotomy due to Becker of general and firm-specific human capital. In the initial Gibbons and Waldman formulation which we employ there is learning-by-doing which means a worker becomes more proficient at a task with experience doing the task.[7] Our focus is what this perspective implies for movements across jobs during a career when upper level jobs require task skills associated with multiple lower level jobs. Note that Gibbons and Waldman in their 2004 paper briefly discuss the idea that lateral moves may be associated with the promotion process in a setting in which task-specific human capital is important. But that paper provides no formal analysis and does not develop testable predictions.

There is substantial evidence that supports the importance of task-specific human capital in labor market settings. Using German data, Gathmann and Schoenberg (2010) show that the

[6] Clemens defines fast jobs as positions associated with a high probability of subsequent promotion while slow jobs are those associated with a low probability of subsequent promotion.

[7] Delfgaauw and Swank (2016) move away from the idea that task-specific human capital is solely due to learning-by-doing and allow workers to invest in the accumulation of task-specific skills.

types of jobs workers move from to those they move to when moving across firms is consistent with task-specific human capital being important. They also estimate that task-specific human capital accounts for between 22 percent to 52 percent of overall wage growth during careers. Using a sample of one percent of the British workforce, Devereux et al. (2013) find that a large proportion of the returns to firm tenure is the result of job-level tenure within firms rather than firm-level tenure. Using data from 76 firms in the US Information Technology industry, Schulz et al. (2013) show that task-specific human capital (measured by job tenure) is positively associated with employee compensation. Our study extends these investigations by exploring the idea that workers can acquire a more valuable stock of task-specific human capital through lateral moves.

As mentioned briefly in the Introduction, probably the closest papers to our paper are Lazear (2012) and Frederiksen and Kato (2014) which do not explicitly consider lateral moves but rather focus on a theory of leadership.[8] Lazear's paper puts forth the theory that a balanced skill set is valuable for corporate leaders. Lazear then provides evidence consistent with the theory based on a survey of Stanford business school alumni, where the evidence mostly consists of the relationship between number of different jobs held early in careers and the probability the individual attains a high level corporate position later in the career (there is also some discussion concerning courses taken in the MBA program and the probability of achieving a high level corporate position). Frederiksen and Kato find additional supporting evidence employing a dataset comprising all workers in Denmark for the period 1992 to 2002.

In comparison to those papers, we model career movements in a more detailed fashion than Lazear does which enables us to generate a richer set of testable predictions. For example, we derive the prediction that the probability of a lateral move is negatively related to a worker's education level and there is no similar theoretical result or discussion in Lazear's paper. More

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[8] See also Lazear (2005) for a related analysis concerning entrepreneurship.

generally, our focus is on the wage and promotion dynamics associated with lateral moves rather than exploring the number and types of jobs that corporate leaders held earlier in their careers.

III. MODEL AND ANALYSIS

In this section we present and analyze a three-period model characterized by firms with two-level job ladders to capture the relationship between lateral moves and promotions. The model builds on analyses in Gibbons and Waldman (1999; 2006) by introducing multiple divisions and multi-dimensional human capital.

A) The Model

There is free entry into production, where all firms are identical and labor is the only input. Workers and firms are risk neutral and there is no discounting. Workers bear no cost when changing firms and firms bear no costs in hiring and firing workers. Further, there are no long-term contracts and instead employment each period is determined by spot-market contracting.

Each firm has a job ladder consisting of two levels. On level 1 there are two distinct jobs that can be thought of as managers in each of two divisions, while on level 2 there is a single job that can be thought of as being a manager at central headquarters who oversees the two divisions. Let j denote the level 1 job, j=A,B. Workers' careers last three periods, denoted by t, t=1,2,3. The two divisions differ in terms of the type of education that increases productivity and the type of task-specific human capital a worker accumulates when working at a job in the division. These aspects of the model are described in detail below. Workers can move laterally between the two level 1 jobs and vertically between levels. Workers in period t have t-1 periods of labor market experience which is equal to the sum of job level tenures in the three jobs (two jobs at level 1 and one at level 2).

Worker i enters the labor market in period 1 with education level s_i, s_i=1,…,S. Workers also vary in terms of their education type, where type can be thought of as the worker's major or curriculum focus while in school. We assume there are two education types, denoted type A and type B. For workers of each given education level and type, workers' innate abilities are random draws from a distribution function M(.) with density function m(.) which is positive over the interval $[\theta_L, \theta_H]$. Let $E(\theta)$ denote expected innate ability. Note that it might be more realistic to assume that a higher education level translates into a higher value for expected innate ability, but making this change would complicate the analysis with no effect on the qualitative nature of the results.

Let α_{ij} denote worker's i's match quality with the worker's current job assignment given the current assignment is job j on level 1. We assume that if worker i with education of type j is assigned to job j (job k, $k \neq j$) at level 1 in period 1, then $\alpha_{ij}=\alpha$ ($\alpha_{ij}=0$), $\alpha>0$. That is, if a worker with a certain education type (e.g., major) is assigned to the level 1 job that utilizes education of that type, she is more productive. Similarly, if worker i with education type j is assigned to job j (job k, $k \neq j$) in period 2 or period 3 and was also assigned to job j (either job) in period 1, then $\alpha_{ij}=\alpha$ ($\alpha_{ij}=0$). But if worker i of type j is not assigned to job j in period 1, then the match quality fully depreciates, i.e., $\alpha_{ij}=0$ if worker i of type j is assigned to job j in period 2 or 3 when the worker was assigned to job k, $k \neq j$, in period 1.[9] Like education levels, a worker's education type is fully observable to all labor market participants.

In our model both more experience on a job and a higher education level, given the education type matches the job assignment, make a worker more productive. Further, in our specification schooling and experience are substitutes (see, e.g., Mincer 1958; 1962), while innate ability and human capital are complements (see, e.g., Acemoglu and Pischke 1998; Gibbons and Waldman 1999). Also, below x_{ijt} denotes worker i's tenure on job j at level 1 prior to period t, while x_{i2t} denotes worker i's tenure on level 2 prior to period t.

If worker i is assigned to job j on level 1 in period t, then the worker's period t output is given by equation (1).

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[9] If we assumed that α_{ij} in this case equals $\lambda\alpha$, $0<\lambda<1$, rather than zero, then results would be similar given λ sufficiently small.

$$y_{ijt} = d_1 + c_1\theta_i f(x_{ijt} + \alpha_{ij}s_i),\ j = A,B \quad (1)$$

In equation (1), f(.) is twice continuously differentiable, strictly increasing and concave, and f(0)>0. f(.) captures the worker's task-specific human capital accumulation which, consistent with the discussion above, depends on experience, education, and match quality, where the education match and the education level enter multiplicatively in the level 1 production function.[10]

If worker i is assigned to level 2 in period t, then the worker's period t output is given by equation (2). Note, below α_{ij} is the worker's match quality with job j if the worker were to be assigned to job j in period t.

$$y_{i2t} = d_2 + c_2\theta_i[g(x_{i2t} + \gamma s_i) + h(x_{iAt} + \alpha_{iA}s_i) + h(x_{iBt} + \alpha_{iB}s_i)] \quad (2)$$

In equation (2) both g(.) and h(.) are twice continuously differentiable, strictly increasing and concave, and g(0)>0 and h(0)>0. Equation (2) tells us that the upper level job uses task skills from both lower level jobs. Further, given the concavity of h(.), a worker in job 2 is more productive with a period of prior experience in each of the lower level jobs than with two periods of prior experience in the lower level job that matches the worker's education type, i.e., a balanced skill set is more productive. We further assume that a worker's education level affects productivity on job 2 independent of the effect through task-specific skills, where γ serves to determine the size of this effect. We assume $d_1 > d_2$ and $c_1 < c_2$ following Gibbons and Waldman (1999; 2006).

In our model human capital is task specific in three ways. First, task skills acquired on one job on level 1 are not applicable to the other level 1 job. For example, a worker assigned to job A in period 1 and B in period 2 is no more productive in period 2 (in fact, less productive if the worker is of type B) than the worker would have been in period 1 if she had been assigned to

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[10] In our specification education does not increase productivity if the education type and job assignment do not match. We could allow some increase in productivity even when there is no match and there would be no change in the qualitative nature of the results as long as the effect of education on productivity is larger when education type and job assignment do match. Also, the linear specification we employ concerning how job tenure and schooling level determine task-specific human capital accumulation is not required for our results.

B. Second, task skills acquired through education of one type are only applicable to the level 1 job of the same type. Third, a balanced level-1 skill set translates into higher productivity on the level 2 job.

The timing of the game is as follows. At the beginning of period 1 firms observe each individual's education level and type but not her ability level. Each firm then offers each individual a wage and job assignment for first period employment. Then each individual chooses a firm for first period employment and production takes place. At the end of period 1, all firms observe each worker's output and update beliefs concerning each worker's ability. Note that parameter restrictions imposed later yield that in equilibrium all individuals work in job A or B on level 1 in period 1.

At the beginning of period 2 each firm offers each individual a wage and job assignment for second period employment, where a worker can be promoted to level 2, laterally moved to a different job on level 1, or kept in the same job. Each individual then chooses a firm for second period employment, production takes place, and outputs are publicly observed. In period 3 the process repeats one more time. Also, our focus is Perfect Bayesian equilibria without turnover which is equivalent to assuming there is an infinitesimally small amount of firm specific human capital.

B) Analysis

In order to reduce the number of cases that need to be considered, we focus on parameterizations such that all workers are assigned to a level 1 job in period 1. Also, in order to focus on the most empirically relevant part of the parameter space, we impose additional parameter restrictions. First, we assume the parameters are such that for workers of each schooling level some workers are assigned to each of the two jobs in periods 3.[11] Second, we

[11] The exact parameter restrictions that ensure these conditions are (i) $d_2 + c_2\theta_L[g(\gamma s_i) + h(1 + \alpha s_i) + h(1)] < d_1 + c_1\theta_L[f(2 + \alpha s_i) + f(1 + \alpha s_i) - f(0)]$ and (ii) $d_2 + c_2\theta_H[g(1 + \gamma s_i) + h(1 + \alpha s_i) + 2h(0) - h(1)] > d_1 + c_1\theta_H f(0)$.

assume that $c_2 >> c_1$ and γ is large. These two assumptions ensure that the incentive to promote a worker is strictly increasing with innate ability and with the education level. Third, we also assume that the task-specific human capital associated with education of level S is large. More formally, we assume that S is sufficiently large that the right hand side of equation (3) below exceeds the left hand side. This last assumption is discussed further below.

In equilibrium in our model each worker in period 1 is assigned to the level 1 job for which the worker is better matched, i.e., workers with type A education are assigned to job A in period 1 while type B workers are assigned to job B. Given this, starting in period 2 there are four possible sequences of job assignments for the remainder of a worker's career that are consistent with equilibrium behavior: i) the worker is promoted in period 2 and remains at level 2 in period 3; ii) the worker does not move jobs in period 2 and is promoted in period 3; iii) the worker is laterally moved in period 2 and then promoted in period 3; and iv) the worker does not move jobs in either period 2 or period 3.

Note that there are sequences that cannot arise in equilibrium. First, because a worker's accumulated task-specific human capital loses value immediately after a lateral move (see below for further discussion), it is never equilibrium behavior for a worker to be laterally moved in period 2 and not promoted in period 3. Second, there are no demotions. At the end of the analysis we discuss an enrichment of the model that generates the same testable implications but for which these two sequences of career moves are consistent with equilibrium behavior.

Consider a worker who in equilibrium remains on level 1 in period 2 and is promoted in period 3. If the worker is laterally moved in period 2, then there is a decrease in period 2 output because the human capital accumulated in period 1 is not utilized in period 2 and because the period 2 job does not match the worker's education type. But there is an increase in period 3 output because a period of task-specific tenure on each lower level job is more valuable on job 2 than two periods on the worker's period 1 job assignment. Formally, if worker i remains on level 1 in period 2 and is promoted in period 3, then the worker is (is not) laterally moved in period 2 when equation (3) is satisfied.

(3) $$c_2\theta_i[h(1 + \alpha s_i) + h(1) - h(2 + \alpha s_i) - h(0)] >(<) c_1\theta_i[f(1 + \alpha s_i) - f(0)]$$

The left hand side of equation (3) is the increase in period 3 output associated with the lateral move given the worker is promoted in period 3, while the right hand side of equation (3) is the decrease in period 2 output associated with the lateral move. In the next subsection we use this relationship to derive a prediction concerning the relationship between lateral moves and education.

We now characterize equilibrium behavior in this model. Note that all proofs are in the Appendix.

Proposition 1: In any equilibrium there exists functions $\theta'(s)$ and $\theta''(s)$, $\theta'(s) \leq \theta''(s)$ for all s, s=1,…S, such that behavior satisfies i) through vii).[12]

i) In period 1 each worker i with schooling type A(B) works at a firm in job A(B) at level 1 and is paid $d_1 + c_1E(\theta)f(\alpha s_i)$.

ii) In each of periods 2 and 3, if the ability of worker i with schooling level s_i and schooling type A(B) is such that $\theta_i < \theta'(s_i)$, then the worker remains in job A(B) at level 1 and is paid $d_1 + c_1\theta_i f(1 + \alpha s_i)$ in period 2 and $d_1 + c_1\theta_i f(2 + \alpha s_i)$ in period 3.

iii) In each of periods 2 and 3, if the ability of worker i with schooling level s_i and schooling type A(B) is such that $\theta_i \geq \theta''(s_i)$, then the worker is assigned to job 2 and is paid $d_2 + c_2\theta_i[g(\gamma s_i) + h(1 + \alpha s_i) + h(0)]$ in period 2 and $d_2 + c_2\theta_i[g(1 + \gamma s_i) + h(1 + \alpha s_i) + h(0)]$ in period 3.

iv) In period 2, if the ability of worker i with schooling level s_i is such that $\theta'(s_i) \leq \theta_i < \theta''(s_i)$, then the worker is assigned to either job A or job B at level 1, while in period 3 the worker is assigned to job level 2.

v) If $\theta'(s_i) \leq \theta_i < \theta''(s_i)$ and the worker is laterally moved in period 2, then the worker is paid $d_1 + c_1\theta_i f(0)$ in period 2 and $d_2 + c_2\theta_i[g(\gamma s_i) + h(1 + \alpha s_i) + h(1)]$ in period 3.

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[12] We assume that a worker is promoted when a firm is indifferent between promotion and no promotion.

vi) If $\theta'(s_i) \leq \theta_i < \theta''(s_i)$ and the worker is not laterally moved in period 2, then the worker is paid $d_1 + c_1\theta_i f(1+\alpha s_i)$ in period 2 and $d_2 + c_2\theta_i[g(\gamma s_i) + h(2+\alpha s_i) + h(0)]$ in period 3.

vii) There is no turnover.

The main finding in Proposition 1 concerns the relationship between a worker's innate ability level and whether and when a worker is promoted. Following, for example, Rosen (1982) and Gibbons and Waldman (1999), we assume that innate ability is more valuable in the higher level job. The result is that for each schooling level there are two critical values for innate ability. If a worker's innate ability is below the lower critical value, then the worker is never promoted. Further, since the return to a lateral move is higher productivity after a promotion, the result that these workers are never promoted means that these workers also stay on the same job in all three periods, i.e., there are no lateral moves. In contrast, if a worker's innate ability is above the higher critical value, then the worker is promoted in period 2 and remains at level 2 in period 3. Since these workers are only at a level 1 job for a single period, these workers are also characterized by no lateral moves. Finally, workers in the intermediate range of innate abilities remain on level 1 in period 2 and are promoted in period 3. Below, we consider this case in more detail.

C) Testable Predictions

In this subsection we derive and discuss a number of testable predictions concerning the model analyzed in the previous subsection, where our focus is parameterizations for which there is a positive frequency of lateral moves.

Corollary 1: The probability of promotion in period 3 is higher for workers laterally moved in period 2 than for workers who remain on job level 1 in period 2 and are not laterally moved.

One way to understand this prediction was discussed in the previous subsection. When a worker is laterally moved the cost is an immediate decrease in productivity while the return is an increase in productivity if the worker is eventually promoted. Given this, a lateral move in period 2 is only beneficial when the move is followed by a high probability of promotion in period 3. Another way to understand the prediction concerns the abilities and human capital accumulation of workers who are laterally moved. That is, workers who are laterally moved are more likely to be subsequently promoted than workers neither laterally moved nor promoted because they have higher innate abilities and they have accumulated human capital which makes them more productive on the higher level job.

We now consider wage increases that follow a lateral move.

Corollary 2: For any schooling level associated with a positive frequency of lateral moves, on average, workers with that schooling level who are laterally moved in period 2 receive higher wage increases in period 3 than those who remain on job level 1 in period 2 and are not laterally moved, i.e., lateral moves are followed by high subsequent wage increases.

There are two reasons for the result described in Corollary 2. Consider a schooling level for which some workers are laterally moved in period 2. First, workers with this schooling level who are laterally moved in period 2 have higher innate ability levels than workers with this schooling level who are neither promoted nor laterally moved in period 2. And because innate ability and human capital are complements in the production functions, the increase in human capital from period 2 to period 3 translates into a larger period 3 wage increase when innate ability is higher. Second, as discussed earlier, the lateral move itself decreases period 2 productivity and increases period 3 productivity. Since wages in this model in each of periods 2 and 3 equal productivity, we now have that a lateral move in period 2 translates into a lower period 2 wage and a higher period 3 wage or, equivalently, a high period 3 wage increase.

The third testable prediction follows from our assumption that the task-specific human capital associated with education of level S is large. This prediction concerns the relationship between education and the frequency of lateral moves.

Corollary 3: There exists an education level, s', $s' \leq S$, such that workers with education level s' or higher are never laterally moved, while worker i with education level below s' is laterally moved in period 2 if $\theta'(s_i) \leq \theta_i < \theta''(s_i)$.

The logic for this result follows from equation (3). Given $f' > 0$, the right hand side of equation (3) is strictly increasing in s_i. Further, given $h' > 0$, the terms in the square bracket on the left hand side of (3) never exceeds h(1). As mentioned, our assumption that the task-specific human capital associated with education of level S is large is formally that the right hand side of equation (3) is larger than the left hand side for s_i=S.[13] In words, we assume that the task-specific human capital accumulated through education for the highest education level is such that the immediate loss in productivity associated with a lateral move exceeds the subsequent gain that follows once the worker is promoted.[14]

Now consider workers in the intermediate range of innate abilities. This is the set of workers who remain on level 1 in period 2 and are promoted in period 3. The previous discussion tells us that when education is high the immediate decrease in period 2 productivity associated with a lateral move is larger than the increase associated with promotion in period 3. As a result, workers with high levels of education are never laterally moved.

In summary, we focus on three testable predictions. First, lateral moves are associated with a higher probability of subsequent promotion. Second, lateral moves are associated with

[13] To be precise, the assumption is that f(.) is not bounded from above and S is large.
[14] As an example, in academic settings PhD economists are typically not laterally moved from teaching to the human resources department for a year or two prior to promotion to a Dean's position. Consistent with the assumption, this is likely because the short term cost of such a move exceeds any subsequent increased productivity due to the move once the individual becomes a Dean.

higher subsequent wage or compensation growth. Third, workers with very high levels of education have zero or few lateral moves.

Note that in interpreting the model in terms of testable predictions we are not always taking the exact equilibrium outcome as the prediction but rather a related prediction. For example, consider the prediction that lateral moves are associated with a higher probability of subsequent promotion. The actual equilibrium outcome is that every worker laterally moved in period 2 is promoted in period 3 but we do not take that as the testable prediction. The reason is that realistic enrichments of the model would eliminate the result that all laterally moved workers are subsequently promoted but would retain the result that laterally moved workers have a higher probability of subsequent promotion. For example, if we introduced a stochastic element into the production functions, then laterally moved workers would have a higher probability of subsequent promotion but that probability would not equal one. In our theoretical analysis we do not incorporate this type of stochastic element so that the basic logic behind our results is easier to see.

IV. DATA

Our data is from a large employer-employee linked panel dataset on high level executives at large US corporations. Data on top managers are suitable for this study for two reasons. First, evidence concerning high level managerial positions is consistent with our assumption that jobs at higher levels of the job ladder employ a wider set of skills than lower level jobs (see footnote 2 for a discussion). Second, various descriptive discussions of the use of lateral moves among high level managerial employees are consistent with the basic argument we investigate. For example, Campion et al. (1994) argued that for high level managerial employees lateral moves are used to give managers a "broader perspective on other business functions."

The original dataset contains information on over 30,000 executives in over 500 of the largest US firms during the period 1981-1988.[15] A unique identifier is assigned to each firm. However, the same individual may have different identifiers in different firms, which means we cannot track individuals across firms.

The dataset contains three compensation related variables: base pay, bonus pay, and pay midgrade. The original dataset records these values in nominal terms and we use the Consumer Price Index provided by the Bureau of Labor Statistics to construct inflation adjusted values recorded in 1982 US dollars. We also construct a measure of total pay which we define as the sum of base pay and bonus pay.

Three variables in the dataset define an individual's position in the firm: reporting level, organizational unit level, and job code. The reporting level is a count of the number of levels away from the Board of Directors (BOD). The CEO directly reports to the BOD and thus is at reporting level 1. All executives who directly report to the CEO are at reporting level 2, executives who directly report to level 2 executives are at reporting level 3, etc. The organizational unit level is a count of the "distance" of the organizational unit from the BOD. An organizational unit is a company, group, division, sales region, or manufacturing facility that the company treats as a separate profit center. In a hypothetical organization in which a division manager reports to a group executive who in turn reports to a corporate or central headquarters executive, the division manager is at Unit Level 3, the group executive is at Unit Level 2, and the corporate executive is at Unit Level 1. Job codes are workers' job titles. There are 11 reporting levels, 8 unit levels, and 165 job codes or titles.

To define job transitions, we use the reporting level as a basic measure. We define promotion as an upward movement in the reporting level (e.g., from level 4 to level 3). Since

[15] The dataset was constructed by a large consulting firm from annual surveys of the participating firms. Firms were paid to participate in the surveys. Each firm reported data concerning about 80 executives per year. The dataset contains rich information on individual, job, and firm characteristics. Specific information collected includes worker age, years of education, hiring date, job title, reporting level, unit level, base pay, bonus pay, pay midgrade, the firm's industry, profits, sales, span of control, and employment size. See Abowd (1990), Gittings (2012), and Belzil et al. (2012) for more detail about the dataset and the data collection procedure.

executives at different unit levels can share the same job title, we do not restrict promotions to upward movements with a job title change.[16] However, we define demotion as a downward movement in the reporting level with a job title change. As Belzil et al. (2012) point out, there is an organizational restructuring during our sample period in which the COO position was added between the CEO and lower level executives. This organizational change causes a universal downward movement of reporting levels without actual demotions occurring. Therefore, we define a demotion for our purposes as occurring when an individual moves down a reporting level and there is a job title change.

To define lateral moves we focus on moves that do not change the worker's reporting level. Conceptually, a lateral move is one that entails a change in the content of the job without a change in the worker's hierarchical position within the firm. Due to data constraints, we cannot identify lateral moves between different divisions within the same unit level. We thus define lateral moves as movements within the same reporting level that include a change in job level or unit level. These types of lateral moves should provide executives with opportunities to acquire different types of task-specific skills through employment in another job or business unit.[17]

Since job tenure is not recorded after 1985, we focus on the years 1981 to 1985. Also, we focus on executives who are observed for all five years. This gives us a balanced sample of 5,676 executives in 160 firms and 28,380 executive-year observations.

Table 1 provides summary statistics for the sample we use in our empirical tests. Panel A shows individual characteristics in 1981. The median age of the executives is 48, which is higher than the median age of the general working population in the US.[18] These executives have, on average, 4.2 years of job tenure in their current positions and 15.1 years of firm tenure.

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[16] For example, a transition from the Top Personnel Executive in a profit center to the Top Corporate Personnel Executive in central headquarters comes with no job title change but is clearly a promotion.

[17] As a robustness check, we have conducted our tests not classifying as lateral moves the job transitions that include a move from a lower to a higher level unit (e.g., from Unit Level 3 to Unit Level 2) without a reporting level change since this type of movement could be considered a promotion. Making this change has no effect on the qualitative nature of the results.

[18] The median age of the US workforce was 34.6 in 1980 according to the Bureau of Labor Statistics (Toossi, 2002).

The average years of education is 16.5. Most of the executives are on reporting levels 1 through 7 and we focus our empirical tests on these levels. Panel B summarizes different compensation measures by year for executives in our sample. The average annual real total earnings in 1982 US dollars grew from $107,726 in 1981 to $138,157 in 1985. Bonuses count for approximately 21 to 26 percent of total compensation in each year. Panel C reports statistics concerning firm characteristics and job transitions. We can see that during the sample period, firm sales and profits are volatile. In order to capture these organizational level volatilities that might potentially affect within firm career dynamics, we control for these firm-level characteristics as well as firm size in our empirical analysis following Abowd et al. (1999). With regard to job transitions within firms, roughly 12 percent of workers are promoted annually, 11 percent are laterally moved, and 2 percent to 3 percent are demoted.[19] Note that in this dataset the frequency of lateral moves is almost as high as the frequency of promotions. Also, not reported in the table is that 5.6 percent of the executives are promoted more than one time in our sample period, while about 12.3 percent of the executives experience more than one lateral move.

V. EMPIRICAL TESTS

In this section, we test the theoretical predictions derived in Section III. We start with tests concerning lateral moves and the probability of subsequent promotion. We then consider the relationship between lateral moves and subsequent compensation changes and the relationship between lateral moves and education.

A) Lateral Moves and Promotion Probabilities

Our first testable prediction captured in Corollary 1 is that lateral moves in one period are correlated with a higher probability of promotion in subsequent periods. The basic logic is that

[19] The lateral move rate is 22.5 percent from 1984 to 1985. This spike is caused by an increase in the number of unit level changes from 1984 to 1985 and that we define lateral moves as a unit level or job title change in which there is no reporting level change. In the following analysis, only lateral moves in 1982 and 1983 are considered so the spike in the 1985 lateral move rate is not a significant concern.

lateral moves result in an immediate loss in productivity because a lateral move makes already accumulated human capital less valuable immediately after the move, so it is only beneficial if there is a high probability of subsequent promotion at which point in time the lateral move increases productivity.

Table 2 reports the probabilities of promotion in following years after a lateral move in a particular year. The top panel in Table 2 shows that among those executives who are laterally moved in 1982, 14.4 percent are promoted in 1983 while only 11.0 percent who are not laterally moved in 1982 are promoted in 1983. For movers in 1982, the percent promoted in 1984 is 14.7 percent while only 13.6 percent of the 1982 non-movers are promoted in 1984. Similarly, in 1985, 14.0 percent of the 1982 movers are promoted while only 11.1 percent of non-movers are promoted. Overall, in the three-year period from 1983 to 1985, lateral movers in 1982 are promoted in 14.4 percent of worker years and non-movers are promoted in 11.7 percent of worker years. These simple descriptive statistics show a clear pattern of a positive correlation between lateral moves and subsequent promotions among the 1982 cohort. For executives who are laterally moved in 1983, a similar pattern is found – the promotion rate is positively correlated with lateral move status in each year and in the two-year average. For those who are laterally moved in 1984, we observe a slightly lower rate of promotion one year after the move. This might due to the fact that the organizational restructuring from 1984 to 1985 leads to an under classification of promotions in 1985 (see footnote 19).[20]

To more formally investigate the relationship between lateral moves and the probability of subsequent promotion, we estimate a reduced form model of promotion in which the probability of promotion is a function of individual and firm characteristics and whether or not an individual was previously laterally moved. Also, rather than pooling all lateral moves together, we consider lateral moves in different years separately.[21] Further, in conducting the

[20] This might also due to the fact that it takes more than a single year for laterally moved workers to accumulate sufficient task-specific human skills on the new job to make promotion beneficial.

[21] If we instead pooled lateral move cohorts together, we would still want to control for the year of the lateral move and the time period between the lateral move and the promotion. So the pooled regression approach would basically

tests that follow we drop from the sample workers who are promoted in the lateral move year and workers who are laterally moved in a year after the lateral move year. These sample restrictions are consistent with Corollary 1 which is the theoretical result that underlies the testable prediction.

We estimate the following equation, where $Prob(Prom_{imt} = 1)$ is the probability that individual i in firm m is promoted in period t.

$$(4)\ Prob(Prom_{imt} = 1) = F(\beta_1 Lat_{im\tau} + \beta_2 total_{imt-1} + \beta_3 Lev_{imt-1} + \beta_4 M_{mt-1} + \beta_5 Unemp_{t-1} + C_{im})$$

F(.) is a cumulative distribution function. $Lat_{im\tau}$ is an indicator variable that equals one if individual i was laterally moved in period τ ($\tau < t$) and zero otherwise. $total_{imt-1}$ is the individual's real total compensation in the previous period, which serves as a proxy for an individual's expected output in the past period. Lev_{imt-1} is a set of indicator variables that capture the individual's reporting level in t-1 (we exclude observations in which the individual was on reporting level 1 (CEO) in period t-1 since promotion in period t is not a possibility for such a worker). M_{mt-1} is a set of firm specific characteristics that include firm sales, profits, and the firm's total employment in period t-1. $Unemp_{t-1}$ is the unemployment rate in t-1 which captures overall labor market conditions.

We also include a set of individual characteristics that are contained in C_{im}. Specifically, C_{im} consists of an observable component and an orthogonal unobserved component. The specification takes the following form.

$$(5)\qquad C_{im} = c_1 X_{im0} + c_2 total_{im0} + c_3 Unemp_{imh} + c_4 FA_{im0} + u_{im}$$

X_{im0} is a set of human capital measures that include age, education, job tenure, and firm tenure all measured at the point in time when individuals first enter the sample. These measures control for pre-in-sample individual heterogeneity in expected productivity (Wooldridge, 2005). $Unemp_{imh}$ is the unemployment rate when an executive is hired which could affect career advancement

provide results on the same subsamples that we consider in separate regressions. Our separate regression approach is equivalent to the pooled regression approach given a full set of interaction variables. We feel that reporting the results as a set of separate regressions makes the results easier to interpret.

through various avenues such as cohort effects. FA_{im0} captures the individual's initial functional area at the time the individual enters the sample. u_{im} denotes the orthogonal unobserved component.

As discussed earlier, in our theoretical analysis one way to view the effect of lateral moves on subsequent promotion probabilities is that it is the result of the following two factors. First, workers who are laterally moved have higher innate ability levels than those neither laterally moved nor promoted (i.e., selection on ability). Second, a lateral move results in a type of human capital accumulation that makes subsequent promotion more attractive. This second factor can be thought of as the treatment effect of lateral moves. Based on our theory, if there are two individuals who are observationally identical concerning their expected ability, the one who is laterally moved should have a higher probability of subsequent promotion since she accumulates human capital that makes her more productive on the upper level job. In our empirical specification, we include various individual characteristics as well as individuals' past total compensation as controls for innate ability, so the coefficient on the lateral move indicator variable captures the treatment effect of lateral moves, i.e., the effect of lateral moves on the promotion probability net of selection effects on individual ability.

Table 3 reports results from estimating equation (4) using linear probability models (LPMs) and allowing for random correlations in standard errors at the individual level. We focus on whether workers who experienced a lateral move in 1982 had higher subsequent promotion probabilities in years 1983 to 1985. Column (1) reports results without controlling for total pay (as a proxy for expected output) in the past period. We find that those who are laterally moved in 1982 are 2.5 percent more likely to obtain a promotion in the period 1983 to 1985 compared to those who are not laterally moved and the effect is statistically significant at the five percent level. In column (2) we control for past pay and the point estimate is almost unchanged while statistical significance remains at the five percent level.

As Table 2 suggests, the effect of lateral moves on subsequent promotions might vary with the number of years since the move. We consider this possibility in column (3). In particular, we use a full set of interactions between the lateral move indicator variable and years after the move. This allows us to see the effect of lateral moves in 1982 on promotions one, two, and three years after the lateral move. We find that two years after the move those who are laterally moved are 4.0 percent more likely to be promoted compared to non-movers and this effect is significant at the five percent level. We also find that one year after the move there is almost no effect on the promotion probability, while three years after the move the point estimate is that the promotion probability is 2.9 percent higher although this effect is not statistically significant at standard confidence levels. Although not captured in our theoretical model because of the three-period structure, the finding that there is basically no effect one year after the move is consistent with our theoretical approach. If lateral moves increase subsequent promotion probabilities because of the effect of the lateral move on the type of human capital accumulated, then immediately after a lateral move the promotion rate might not increase because it likely takes some time on the new job for the worker to accumulate the human capital that makes promotion more attractive.

Our theoretical model predicts that the probability of promotion rises after a lateral move. In the tests above the unit of observation is whether or not a worker was promoted in a specific year. An alternative empirical approach is to have a single unit of observation for each worker, where the dependent variable captures whether or not the worker was promoted at least once over a period of years. Specifically, in columns (4) and (5) the dependent variable is an indicator variable that captures whether or not the worker was promoted at least once between 1983 and 1985 and the explanatory variable of interest is an indicator that captures whether or not the worker was laterally moved in 1982. We refer to this as the collapsed sample. We also control for individuals' reporting levels in the year of the lateral move as well as other individual characteristics measured in 1981. In column (4) we find that those laterally moved in 1982 are 6.3 percent more likely to subsequently receive at least one promotion, while in column (5) that includes an additional control for average past period pay the figure is 5.6 percent. The results in columns (4) and (5) are statistically significant at the five percent level. Overall, the results focused on 1982 lateral moves are consistent with our theoretical prediction that lateral moves have a positive impact on subsequent promotion probabilities.

In Table 4, we repeat the exercise in Table 3 focusing on lateral moves in 1983.[22] The results here are qualitatively similar to the results in Table 3, although the point estimates are in many cases larger. There is, however, one difference worth mentioning. In contrast to the results in column (3) of Table 3, in column (3) of Table 4 lateral moves in 1983 significantly positively affect the probability of promotion one year after the move while the effect is not significant two years after the move. Nevertheless, Table 4 indicates that lateral moves in 1983 have an overall positive impact on subsequent promotions.

In Tables 5 and 6 we repeat the analyses in Tables 3 and 4 using non-linear models. To keep the estimation strategy straightforward, we assume the orthogonal component concerning individual heterogeneity (i.e., u_{im} in equation (5)) follows a normal distribution and implement probit models for estimation.

The results in Table 5 are qualitatively similar to the results in Table 3. On average, the results in columns (1) and (2) indicate that laterally moved workers in 1982 are 2.2 percent more likely to earn a promotion in subsequent years. In column (3) which allows the effect to vary between years we find that the effect of lateral moves in 1982 is strongest on promotions in 1984, where in that year workers laterally moved in 1982 are 4.0 percent more likely to be promoted and the effect is statistically significant at the five percent level. The results in that column also indicate a negative but statistically insignificant effect on 1983 promotions and a positive but statistically insignificant effect on 1985 promotions. In each of columns (4) and (5) the effect of 1982 lateral moves on subsequent promotions is large and statistically significant at the five percent level. In Table 6 the results are qualitatively similar to those in Table 4.

Overall, our results support the idea that lateral moves increase subsequent promotion probabilities. That is, although the effect that lateral moves have on the promotion probability in

[22] Since our sample ends in 1985, for the analysis of 1983 lateral movers, we are not able to examine the effect of lateral moves three years after the move.

a specific year depends on how many years have passed since the move, the results taken as a whole make it clear that being laterally moved today increases the probability the laterally moved worker will be promoted at least once in the following few years.

B) Lateral Moves and Future Compensation Growth

In this subsection we investigate the relationship between lateral moves and subsequent compensation changes. Our second testable implication is that lateral moves are associated with high subsequent compensation increases. Figure 1 plots raw compensation data by year as a function of whether or not there was a lateral move in 1982 and similarly for 1983. The top two graphs show the evolution of average total pay and average base pay for 1982 lateral movers and 1982 non-movers. For both compensation measures, non-movers seem to have a higher average pay in 1981 but the movers show a somewhat stronger earnings growth after 1982. In the bottom two graphs we show similar wage plots for 1983 lateral movers and non-movers. From the total pay graph on the bottom left, movers and non-movers' total pay are almost identical before 1983. Starting in 1983, however, movers show stronger earnings growth than non-movers. This pattern exists in the base pay measure as well.

We now more systematically investigate the correlation between lateral moves and subsequent compensation growth. In our theoretical model the higher wage growth after a lateral move is due to the diversified set of skills associated with the move and the resulting high productivity which follows after the worker is promoted. Given the results in the previous subsection, this means that the overall compensation growth for the movers should be larger than that of the non-movers after the lateral move. Because our focus is compensation changes after the lateral move, in our specification we control for changes in firm characteristics but not total pay in the past period. Also, as in the tests in the previous subsection, in conducting the tests we drop from the sample workers who are promoted in the lateral move year and workers who are laterally moved in a year after the lateral move year.

In investigating our second testable prediction we begin with the following specification.

(6) $$w_{imt} - w_{imt-1} = \varphi_1 Lat_{im\tau} + \varphi_2 Lev_{imt} + \varphi_3 \Delta M_{mt} + \bar{C}_{im}$$

The dependent variable is the compensation growth in period t, where t>τ and τ is the period of the lateral moves. $Lat_{im\tau}$ is an indicator variable for lateral moves in period τ. Lev_{imt} is again a set of indicator variables for the individual's reporting level in period t. ΔM_{mt} is a set of variables that include changes in firm specific values including profits, sales, sizes, etc. $\bar{C}_{im}$ is a set of individual characteristics with the only change relative to the specification in equation (5) being that we add an age-squared term to capture the non-monotonic wage-age profile.

Since the theory does not distinguish between base pay and total pay, we estimate equation (6) using both compensation measures as the dependent variable. We also focus on compensation levels rather than log compensation because the theoretical model makes predictions concerning compensation levels. Our approach is to estimate equation (6) using OLS with standard errors clustered at the firm-individual level.

Table 7 focuses on the effect of lateral moves in 1982 on subsequent compensation growth. Columns (1) and (2) look at the effect of lateral moves on subsequent growth in total compensation while columns (3) and (4) look at the effect on base pay. Focusing on columns (1) and (3), we see that the lateral move coefficients are positive as the theory predicts but in each regression the coefficient is not statistically significant at standard confidence levels. In columns (2) and (4) we interact the lateral move indicator variable with indicator variables that capture the number of years of the observation after the lateral move year. The results in columns (2) and (4) are qualitatively similar. In the year immediately after the lateral move year, movers have smaller compensation growth and this effect is statistically significant at the one percent level. Two years after the move, however, movers start to have larger compensation growth. By the third year after the move, a laterally moved individual, on average, enjoys a substantial $9,586 larger growth in total compensation and a $5,651 higher growth in base pay. Further, these coefficients are statistically significant at the one-percent level. Also, in each of columns (2) and (4) the positive compensation change in the third year is larger in absolute value than the negative compensation change in the first year, which results in the average positive compensation changes that we observe in columns (1) and (3). Note that the finding that the increased growth in compensation following a lateral move is not immediate is not surprising given the results in Table 3 where the effect on promotion probabilities is not immediate.

In columns (5) and (6) we treat each worker as a single observation and consider compensation growth between 1982 and 1985. In each column the coefficient is positive, where the effect on total compensation is not statistically significant at standard confidence levels while the effect on base pay is statistically significant at the five-percent level.

In Table 8 we conduct tests analogous to those in Table 7 but for 1983 lateral movers. Similar to the results in Table 7 we find in columns (1) and (3) that, on average, lateral moves are positively correlated with growth in total compensation and base pay but the coefficients are not statistically significant. In columns (2) and (4) where we interact the lateral move indicator variable with indicator variables capturing the number of years of the observation after the lateral move year we find a negative coefficient for the year immediately after the lateral move year and a positive coefficient for the following year. In particular, two years after the move a mover enjoys a $5,817 larger increase in total compensation, on average, and a $2,677 larger gain in base pay. Also, both coefficients are statistically significant at the one-percent level. In columns (5) and (6) which treat each worker as a single observation and the focus is compensation growth between1983 and 1985 the coefficients are each positive but statistically insignificant.

Overall, the results in Tables 7 and 8 are consistent with the prediction that lateral moves are followed by higher subsequent compensation growth, where each table suggests the higher growth is not immediate but starts two or three years after the lateral move year.

C) <u>Lateral Moves and Education</u>

Our third testable prediction is that workers with very high levels of education have zero or few lateral moves. From Table 9, we can see that there is a decline in lateral move rates after

17 years of schooling.[23] For example, the lateral move rate among those who had 17 years of schooling was 16.1 percent while the rate for those who had 19 years of schooling was 8.1 percent. To formally test the prediction that the frequency of lateral moves is lower at higher levels of education, we estimate an equation similar to equation (4) except that the dependent variable is an indicator variable that equals one if the individual was laterally moved in any year t, t=82,83,84,85, and zero otherwise. Also, we include a full set of indicator variables for different education levels where below 16 years of schooling is the omitted category. To be specific, we estimate equation (7) on all observations in which the worker was not promoted in the current period.

$$(7)\ Prob(Lat_{imt} = 1) = F(\delta_1 educ_{imt} + \delta_2 total_{imt-1} + \delta_3 Lev_{imt} + \delta_4 M_{mt} + \delta_5 Unemp_t + \tilde{C}_{im})$$

$educ_{imt}$ is a set of education level indicator variables, while the other variables are as defined previously except for $\tilde{C}_{im}$ which is defined the same way as in equation (5) without the education term.

Table 10 reports results from our estimation of equation (7) using both linear probability models and probit specifications. The results in all of the specifications are consistent with the lateral move probability decreasing significantly when years of schooling is 19 or above. For example, the results of the probit specification in column (3) which does not control for total pay in the previous period indicates that the probability of a lateral move is 6.0 percent lower for those with 19 years of schooling relative to those with 16 years of schooling, while the column (4) specification which does control for total pay in the previous period finds that the decrease in the probability of a lateral move for those with 19 years of schooling is 6.1 percent lower. Further, in both columns the effect is statistically significant at the one percent level. Overall, the results concerning schooling and the probability of lateral moves are consistent with our theoretical prediction that lateral moves should be rare for workers with high levels of education.

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[23] In the original sample, no individuals with more than 21 years of schooling were ever laterally moved which matches the theoretical prediction. However, this evidence is only suggestive given the small number of individuals in the sample with more than 21 years of schooling.

VI. ALTERNATIVE EXPLANATIONS

In this section we discuss whether any of the alternative explanations in the literature for why firms might employ lateral moves can serve as an explanation for our results. Given the similarity between lateral moves and job rotation which is typically described as a pre-determined sequence of lateral moves, alternative explanations for lateral moves can be found in the job rotation literature. One such alternative is found in Ortega (2001). In that paper firms laterally move workers early in careers in order to learn about workers' job specific match values which, in turn, improves the efficiency of job assignments as workers get older.

Clearly, part of the motivation for lateral moves in our dataset could be the desire of firms to learn about job specific match values. This rationale for lateral moves, however, does not provide an alternative explanation for our empirical findings. That is, if lateral moves are used to learn more about efficient matching at a set of jobs at a specific level of a job ladder, there is no clear reason why this should translate into a higher probability of subsequent promotion. Further, it is also unclear in this argument why workers with particularly high levels of education should have a lower frequency of lateral moves.

Another possible explanation for lateral moves is that over time workers themselves learn about the utility or disutility they receive from performing different jobs and this leads to movements across jobs (e.g., Novos 1995). But as is true for the matching argument above, this story does not easily produce predictions consistent with our empirical findings. For example, if a worker moves to a new job on the same job level because the worker learns that the new job produces less disutility for the worker, there is no clear reason why that should increase the probability of subsequent promotion. In fact, one could argue that if disutility is particularly low on the new job after a lateral move, then further moves become less attractive so the probability of promotion should fall rather than rise.

As discussed briefly earlier, Clemens (2012) develops a theory of lateral moves in which there are fast and slow jobs, where fast and slow refer to the frequency with which a worker in a certain job earns a promotion. In this theory a lateral move will increase the probability of subsequent promotion if the move is into a fast job and will decrease this probability if the lateral move is into a slow job. We have conducted tests (not reported) looking for whether certain types of lateral moves are associated with decreases in the probability of subsequent promotion and we have not identified this type of lateral move in our data set. Also, this theory does not explain why lateral moves seem to be uncommon for workers with very high levels of education.

In summary, other motivations for lateral moves found elsewhere in the literature do not seem consistent with our empirical findings. We thus believe that these empirical results serve as strong evidence in favor of our argument that an important role for lateral moves, especially at high levels of a firm, is to provide laterally moved workers with a broad set of skills in anticipation of a promotion for which these skills are especially valuable.

VII. CONCLUSION

Most of the literature concerning how careers develop inside firms focuses on how workers move across jobs in a vertical fashion, i.e., promotions. But evidence shows that lateral moves, i.e., movements across jobs at the same job level, are a common feature in internal labor markets. In the first part of this paper we develop a theory of the role of lateral moves based on the idea that higher level positions employ various types of task-specific human capital, so lateral moves are useful for preparing workers for promotions because they diversify a worker’s skill set. In addition to formalizing the basic argument, our theoretical model generates a number of testable implications including that the probability of subsequent promotion should be higher for workers who are laterally moved.

In the second part of the paper we investigate these testable predictions using a multi-firm dataset focused on top managerial employees at 500 of the largest US firms over the time period 1981 to 1985. Our empirical investigation supports the three main predictions of our theoretical analysis: i) lateral moves are associated with a higher probability of subsequent promotion; ii) lateral moves are associated with higher subsequent compensation growth; and iii) workers with very high levels of education are rarely laterally moved. So, overall, our empirical investigation supports the idea that lateral moves are important for diversifying a worker’s stock of task-specific human capital which, in turn, serves to increase the worker’s productivity after the worker is subsequently promoted.

Table 1. Executive Characteristics, Compensation, Firm Characteristics, and Job Transitions

A. Executive Characteristics in 1981					
Level	No. of Executives	Firm Tenure	Job Tenure	Age (median)	Education
all	**5,676**	**15.1**	**4.2**	**48.0**	**16.5**
1	108	21.1	7.0	56.0	17.2
2	489	16.0	4.1	51.0	17.0
3	1,327	14.0	4.1	48.0	16.8
4	1,858	14.9	4.1	47.0	16.5
5	1,239	15.0	4.1	46.0	16.2
6	493	16.1	4.1	47.0	16.0
7	124	17.4	5.0	47.0	15.3
8	24	19.3	4.4	48.0	14.7
9	10	24.1	3.5	53.5	14.9
10	3	13.0	4.0	46.0	14.0
11	1	18.0	1.0	57.0	16.0
B. Compensation Measures by Sampling Year: 1981-85					
Year	1981	1982	1983	1984	1985
Mean Total Pay (real)	$107,726	$117,285	$118,372	$127,421	$138,157
Mean Base Pay (real)	$84,072	$89,249	$93,943	$98,211	$102,921
Mean Bonus (real)	$23,655	$28,037	$24,429	$29,210	$35,236
C. Firm Characteristics and Job Transition Status by Sampling Year					
Year		1981-1982	1982-1983	1983-1984	1984-1985
pct. Change in sales		11.1%	3.5%	3.7%	12.2%
pct. Change in profits		-1.5%	55.0%	-23.5%	39.1%
pct. Change in firm size		1.2%	-0.9%	-0.4%	4.8%
Promotion		12.2%	11.3%	13.4%	12.1%
Lateral move		11.6%	10.9%	10.8%	22.5%
Demotion		1.9%	1.7%	1.1%	2.5%

Note 1 - Real total pay, base pay, and bonus pay are in 1982 US dollars

Note 2 - Sample restricted to executives who show up five times during the 1981-1985 sampling period

Table 2. Lateral Moves and Subsequent Promotions by Year

Year of Lateral Move		*Year of Promotion* 1983	1984	1985	Overall
		1 year after	*2 years after*	*3 years after*	*1983-85*
1982	Mover	90	92	88	270
		14.4%	14.7%	14.0%	14.4%
	Non-mover	477	588	483	1684
		11.0%	13.6%	11.1%	11.7%
			1 year after	*2 years after*	*1984-85*
1983	Mover		103	91	194
			15.6%	13.8%	14.7%
	Non-mover		582	496	1147
			13.2%	11.3%	12.2%
				1 year after	*1985*
1984	Mover			72	72
				11.0%	11.0%
	Non-mover			542	542
				12.6%	12.6%

Note 1 - Sample restricted to executives who show up five times during the 1981-1985 sampling period and who are not promoted in the period of the lateral move.

Table 3. Lateral Moves in 1982 and Subsequent Promotion Probabilities: Linear Probability Models

Dependent Variable:	Five-year sample			Collapsed sample	
Promotion (t)=1 if yes	(1)	(2)	(3)	(4)	(5)
Lateral (τ)	0.025**	0.024**		0.063**	0.056**
	(0.011)	(0.011)		(0.026)	(0.026)
Lateral move effect by year					
Lateral (τ)*Year 83			0.007		
			(0.018)		
Lateral (τ)*Year 84			0.040**		
			(0.020)		
Lateral (τ)*Year 85			0.029		
			(0.019)		
Past in-sample observables					
Total pay in 10k(t-1)		*Yes*	*Yes*		*Yes*
Levels (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Unemp. Rate (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm Characteristics (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Constant	0.228***	0.223***	0.237***	0.619***	0.625***
	(0.050)	(0.050)	(0.051)	(0.099)	(0.099)
Observations	10,144	10,144	10,392	3,455	3,455

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1982, and who are not laterally moved in other periods.. Firm characteristics include firms' profits, sales, and total employment. Individual characteristics include education, age, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 4. Lateral Moves in 1983 and Subsequent Promotion Probabilities: Linear Probability Models

Dependent Variable:	Five-year sample			Collapsed sample	
Promotion (t)=1 if yes	(1)	(2)	(3)	(4)	(5)
Lateral (τ)	0.032**	0.030**		0.066***	0.061***
	(0.013)	(0.013)		(0.024)	(0.024)
Lateral move effect by year					
Lateral (τ)*Year 84			0.042**		
			(0.020)		
Lateral (τ)*Year 85			0.012		
			(0.018)		
Past in-sample observables					
Total pay in 10k(t-1)		*Yes*	*Yes*		*Yes*
Levels (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Unemp. Rate (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm Characteristics (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Constant	0.254***	0.239***	0.238***	0.616***	0.614***
	(0.063)	(0.063)	(0.062)	(0.094)	(0.093)
Observations	6,878	6,878	7,058	3,471	3,471

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1983, and who are not laterally moved in other periods.. Firm characteristics include firms' profits, sales, and total employment. Individual characteristics include education, age, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 5. Lateral Moves in 1982 and Subsequent Promotion Probabilities: Probit Models

Dependent Variable:	Five-year sample			Collapsed sample	
Promotion (t)=1 if yes	(1)	(2)	(3)	(4)	(5)
Lateral (τ)	0.022**	0.022**		0.063**	0.056**
	(0.010)	(0.010)		(0.025)	(0.025)
Lateral move effect by year					
Lateral (τ)*Year 83			-0.006		
			(0.016)		
Lateral (τ)*Year 84			0.041**		
			(0.018)		
Lateral (τ)*Year 85			0.030		
			(0.019)		
Past in-sample observables					
Total pay in 10k(t-1)		*Yes*	*Yes*		*Yes*
Levels (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Unemp. Rate (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm Characteristics (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	10,144	10,144	10,144	3,455	3,455

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1982, and who are not laterally moved in other periods.. Firm characteristics include firms' profits, sales, and total employment. Individual characteristics include education, age, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981. Average marginal effects are reported.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 6. Lateral Moves in 1983 and Subsequent Promotion Probabilities: Linear Probability Models

Dependent Variable:	Five-year sample			Collapsed sample	
Promotion (t)=1 if yes	(1)	(2)	(3)	(4)	(5)
Lateral (τ)	0.029**	0.026**		0.062***	0.057**
	(0.012)	(0.012)		(0.023)	(0.022)
Lateral move effect by year					
Lateral (τ)*Year 84			0.032*		
			(0.017)		
Lateral (τ)*Year 85			0.019		
			(0.018)		
Past in-sample observables					
Total pay in 10k(t-1)		*Yes*	*Yes*		*Yes*
Levels (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Unemp. Rate (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm Characteristics (t-1)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	6,878	6,878	6,878	3,471	3,471

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1983, and who are not laterally moved in other periods.. Firm characteristics include firms' profits, sales, and total employment. Individual characteristics include education, age, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981. Average marginal effects are reported.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 7. Lateral Moves in 1982 and Subsequent Compensation Growth (in 1982 dollars): Pooled OLS

	Five-year sample				Collapsed sample	
Real Comp. Change from the Year of the Moves:	(1) Total(t)-Total(τ)	(2) Total(t)-Total(τ)	(3) Base(t)-Base(τ)	(4) Base(t)-Base(τ)	(5) Total(t)-Total(τ)	(6) Base(t)-Base(τ)
Lateral (τ)	1,337.637		971.032*		1,698.650	1,969.857**
	(1,265.739)		(548.157)		(2,241.046)	(996.551)
Lateral move effect by year						
Lateral (τ)*Year 83		-6,484.344***		-3,442.369***		
		(1,079.100)		(524.629)		
Lateral (τ)*Year 84		896.257		490.549		
		(1,418.662)		(760.254)		
Lateral (τ)*Year 85		9,659.308***		6,223.012***		
		(2,085.576)		(1,129.288)		
Levels (t)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm & Market Conditions (t)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	10,154	10,154	10,154	10,154	2,744	2,744

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1982, and who are not laterally moved in other periods.. Firm characteristics include firms' profits change, sales change, and total employment change. Market condition includes the unemployment rate change. Individual characteristics include education, age, age squared, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 8. Lateral Moves in 1983 and Subsequent Compensation Growth (in 1982 dollars): Pooled OLS

	Five-year sample				Collapsed sample	
Real Comp. Change from the Year of the Moves:	(1) Total(t)-Total(τ)	(2) Total(t)-Total(τ)	(3) Base(t)-Base(τ)	(4) Base(t)-Base(τ)	(5) Total(t)-Total(τ)	(6) Base(t)-Base(τ)
Lateral (τ)	2,015.097		499.967		4,263.334**	1,822.248**
	(1,376.106)		(500.166)		(2,124.182)	(865.932)
Lateral move effect by year						
Lateral (τ)*Year 84		1,756.188		209.170		
		(1,099.121)		(448.853)		
Lateral (τ)*Year 85		2,273.860		790.601		
		(1,909.490)		(649.736)		
Levels (t)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Firm & Market Conditions (t)	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Individual Initial Characteristics	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	6,876	6,876	6,876	6,876	2,496	2,496

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period, who are not promoted in 1983, and who are not laterally moved in other periods.. Firm characteristics include firms' profits change, sales change, and total employment change. Market condition includes the unemployment rate change. Individual characteristics include education, age, age squared, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981.

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 9. Frequency of Lateral Moves by Education Levels

	Lateral Move in t				
	No		Yes		Total
Years of Education	Freq	Row pct	Freq	Row pct	Freq
12	1,399	82.1%	306	17.9%	1,705
13	143	82.2%	31	17.8%	174
14	576	86.4%	91	13.6%	667
15	173	84.8%	31	15.2%	204
16	9,012	84.8%	1,612	15.2%	10,624
17	2,175	84.0%	414	16.0%	2,589
18	2,818	86.5%	438	13.5%	3,256
19	2,221	91.9%	196	8.1%	2,417
20	947	88.7%	121	11.3%	1,068

Note 1 - Sample restricted to executives who show up five times during the 1981-1985 sampling period and who are not promoted in the period of lateral move.

Table 10. Education and Lateral Moves

Dependent Variable: *Lateral move (t)=1 if yes*	(1) OLS	(2) OLS	(3) Probit	(4) Probit
Years of Education (t) =				
<16	*Ref.*	*Ref.*	*Ref.*	*Ref.*
16	-0.004	-0.004	-0.004	-0.004
	(0.010)	(0.010)	(0.010)	(0.010)
17	0.006	0.006	0.005	0.005
	(0.013)	(0.013)	(0.013)	(0.013)
18	-0.011	-0.011	-0.012	-0.012
	(0.013)	(0.013)	(0.012)	(0.012)
19	-0.050***	-0.050***	-0.060***	-0.061***
	(0.014)	(0.014)	(0.015)	(0.015)
20	-0.037**	-0.037**	-0.042**	-0.042**
	(0.017)	(0.017)	(0.017)	(0.016)
Total pay in 10k (t-1)		yes		yes
Levels (t)	yes	yes	yes	yes
Unemp. Rate (t)	yes	yes	yes	yes
Firm Characteristics (t)	yes	yes	yes	yes
Individual Initial Characteristics	yes	yes	yes	yes
Number of Observations	17,578	17,578	17,578	17,578

Note: Standard errors are clustered at firm-individual level. Sample restricted to executives who show up five times during the 1981-1985 sampling period and who are not promoted in the current period. Firm characteristics include firms' profits, sales, and total employment. Individual characteristics include age, job tenure, employer tenure, unemployment rate at hiring, total pay in 1981, and functional areas in 1981. Average Marginal Effects are reported in columns (3) and (4).

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

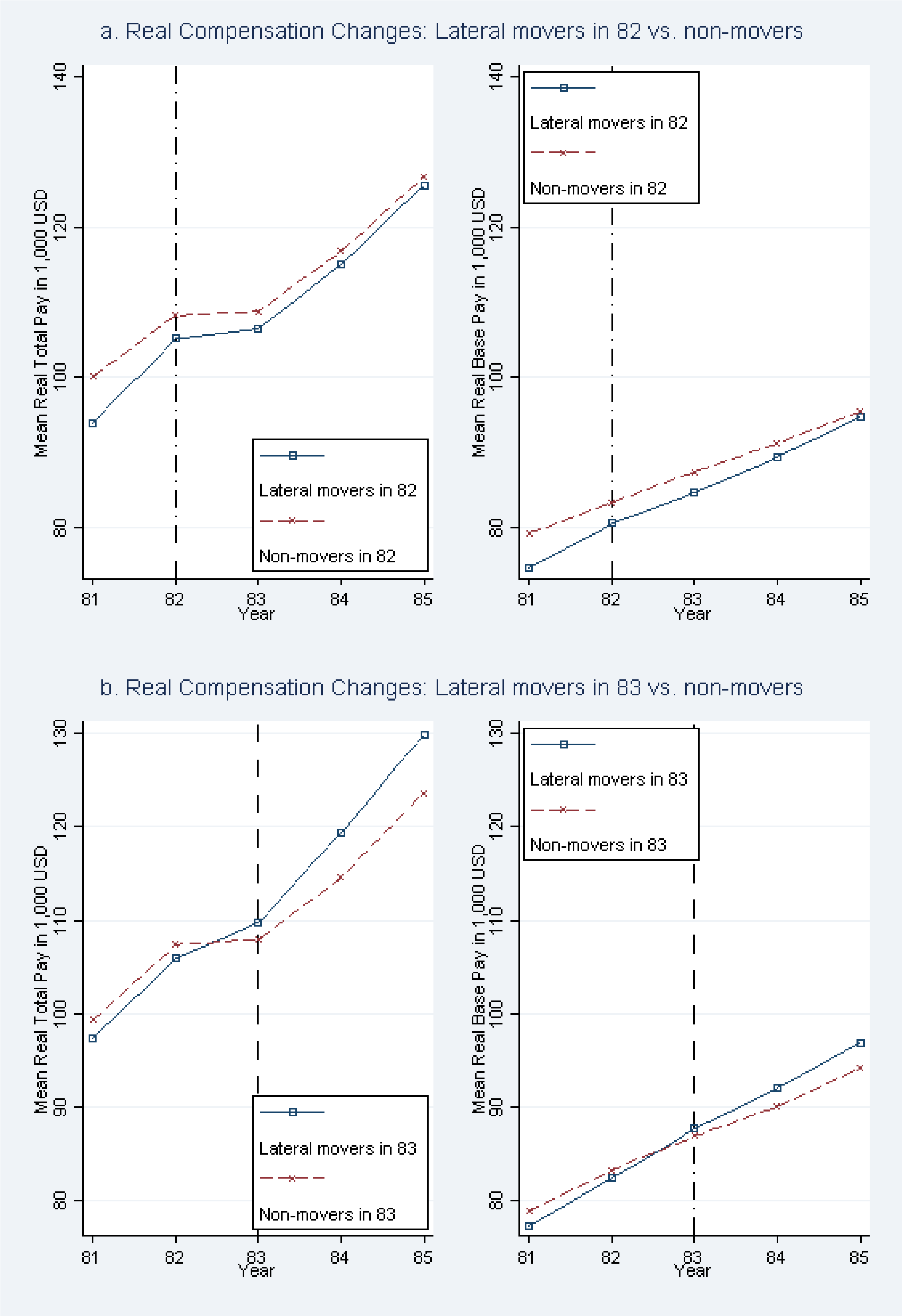

Figure 1 Total pay and base pay by year

APPENDIX

Derivation of the parameter restriction in equation (3)

Let us consider the four possible equilibrium career development paths (all other paths are strictly dominated as explained in the text) for a type- j worker and her total productivity in all three periods associated with each of the four career paths. Since in each path, the productivity in period 1 is the same, we simply consider the total productivity in periods 2 and 3. Since there is free entry, firms make zero profit by paying out all the expected output as wages. Thus, the firms' problem is to maximize expected productivity by assigning workers optimally. $\Pi_{j,2,2}$ denotes the total productivity (in period 2 and 3) of a type- j worker who starts in job j, is promoted to level 2 in period 2, and stays on level 2 in period 3. $\Pi_{j,j,2}$ denotes the total productivity of a type- j worker who starts in job j, stays in job j in period 2, and is promoted to level 2 in period 3. This is the productivity of the non-movers. $\Pi_{j,k,2}$ denotes the total productivity of a type- j worker who starts in job j, is laterally moved to job k in period 2, and is promoted to level 2 in period 3. This is the productivity of the movers. Finally, $\Pi_{j,j,j}$ denotes the total productivity of a type- j worker who starts in job j and stays in job j for all three periods. We have the following expressions.

$$\Pi_{j,2,2}(\theta) = \{d_2 + c_2\theta[g(\gamma s) + h(1+\alpha s) + h(0)]\} + \{d_2 + c_2\theta[g(1+\gamma s) + h(1+\alpha s) + h(0)]\} \tag{A1}$$

$$\Pi_{j,j,2}(\theta) = \{d_1 + c_1\theta f(1+\alpha s)\} + \{d_2 + c_2\theta[g(\gamma s) + h(2+\alpha s) + h(0)]\} \tag{A2}$$

$$\Pi_{j,k,2}(\theta) = \{d_1 + c_1\theta f(0)\} + \{d_2 + c_2\theta[g(\gamma s) + h(1+\alpha s) + h(1)]\} \tag{A3}$$

$$\Pi_{j,j,j}(\theta) = \{d_1 + c_1\theta f(1+\alpha s)\} + \{d_1 + c_1\theta f(2+\alpha s)\} \tag{A4}$$

We can see that for any positive θ, either $\Pi_{j,j,2} > \Pi_{j,k,2}$ or $\Pi_{j,k,2} > \Pi_{j,j,2}$.When $\Pi_{j,j,2} > \Pi_{j,k,2}$, there is no lateral move in equilibrium. When $\Pi_{j,k,2} > \Pi_{j,j,2}$, there are lateral moves in equilibrium.

Proof of Proposition 1.

In any equilibrium, since all workers are assigned to their matched job on level 1 in period 1, they are paid their expected output $d_1 + c_1 E(\theta) f(\alpha s)$. This proves i).

Now, let's consider the equilibrium with lateral moves. Equating (A1) and (A3) gives the cutoff ability level to promote a worker versus lateral move her in period 2. Let $\theta''(s)$ solve $\Pi_{j,2,2}(\theta) = \Pi_{j,k,2}(\theta)$. We have

$$\theta''(s) = \frac{d_1 - d_2}{c_2[g(1+\gamma s) + h(1+\alpha s) + 2h(0) - h(1)] - c_1 f(0)}.$$

Similarly, in the equilibrium without lateral moves, equating (A1) and (A2) gives the cutoff ability level to promote a worker versus let her stay in her matched level-1 job for one more period in period 2 before promoting her in period 3. Let $\theta''(s)$ solve $\Pi_{j,2,2}(\theta) = \Pi_{j,j,2}(\theta)$. We have

$$\theta''(s) = \frac{d_1 - d_2}{c_2[g(1+\gamma s) + 2h(1+\alpha s) + h(0) - h(2+\alpha s)] - c_1 f(1+\alpha s)}.$$

That is, in any equilibrium, if $\theta \geq \theta''$, the worker is assigned to job 2 in periods 2 and 3. This proves iii).

Now equate (A4) and (A3). This gives the cutoff ability level to laterally move a worker and then promote her in period 3 versus make her stay in the matched level-1 job in periods 2 and 3. We have

$$\theta'(s) = \frac{d_1 - d_2}{c_2[g(\gamma s) + h(1+\alpha s) + h(1)] - c_1[f(2+\alpha s) + f(1+\alpha s) - f(0)]}.$$

Equating (A4) and (A2) gives the cutoff ability level to make a worker stay in her matched level-1 job in period 2 and then promote her versus make her stay in the matched level-1 job in periods 2 and 3, i.e.,

$$\theta'(s) = \frac{d_1 - d_2}{c_2[g(\gamma s) + h(2 + \alpha s) + h(0)] - c_1 f(2 + \alpha s)}.$$

That is, in any equilibrium, if $\theta < \theta'(s)$, the worker is assigned to job 1 in periods 2 and 3. This proves ii).

In the equilibrium with lateral moves, if $\theta'(s) \leq \theta < \theta''(s)$, the worker is laterally moved in period 2 and is promoted in period 3. In the equilibrium without lateral moves, if $\theta'(s) \leq \theta < \theta''(s)$, the worker remains in her matched job on level-1 in period 2 and is promoted in period 3. This gives iv)-vi). By construction, there is no turnover in equilibrium since the incumbent firm can always match outside wage offers if we assume a very small amount of firm-specific human capital in production.

Proof of Corollary 1.

From Proposition 1, in equilibrium where there are lateral moves, a worker is promoted in period 3 only if she is laterally moved in period 2. That is, movers have a probability of 1 to be promoted versus non-movers have a probability of 0 to be promoted.

Proof of Corollary 2.

Denote the wage change for lateral movers as $\Delta w^m(\theta)$, and the wage change for non-movers $\Delta w^n(\theta)$. From Proposition 1, for a given level of s, we have the following.

$$\Delta w^m(\theta) = d_2 + c_2\theta[g(\gamma s) + h(1 + \alpha s) + h(1)] - [d_1 + c_1\theta f(0)] \qquad \forall\theta \in [\theta', \theta'')$$

$$\Delta w^n(\theta) = d_2 + c_2\theta[g(\gamma s) + h(2 + \alpha s) + h(0)] - [d_1 + c_1\theta f(1 + \alpha s)] \quad \forall\theta \in [\theta_L, \theta')$$

Define $G(s) = g(\gamma s) + h(1 + \alpha s) + h(1)$. Let θ_1 solve $d_2 + c_2\theta_1 G(s) = d_1 + c_1\theta_1 f(2 + \alpha s)$. Since $\Delta w^m(\theta)$ and $\Delta w^n(\theta)$ increase in θ, we only need to show that $\Delta w^m(\theta') > \Delta w^n(\theta')$. In fact, since $\theta' > \theta_1$, we only need to show $\Delta w^m(\theta_1) > \Delta w^n(\theta_1)$. This is straightforward since $\forall\theta \geq \theta' > \theta_1, \Delta w^m(\theta) = [d_2 + c_2\theta G(s)] - [d_1 + c_1\theta f(0)] > \Delta w^m(\theta_1) = [d_2 + c_2\theta_1 G(s)] - [d_1 + c_1\theta_1 f(0)] = [d_1 + c_1\theta_1 f(2 + \alpha s)] - [d_1 + c_1\theta_1 f(0)] > \Delta w^n(\theta_1) = [d_1 + c_1\theta_1 f(2 + \alpha s)] - [d_1 + c_1\theta_1 f(1 + \alpha s)]$.

Proof of Corollary 3.

(see text.)

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