Human Capital and Mobility in the Executive Labor Market[*]

John W. Barry[†] Noah Lyman[‡] Lin Zhao[§]

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Abstract

We estimate a search model of executive careers, allowing for general and firm-specific human capital accumulation, firm and executive heterogeneity, and both internal and external CEO promotions. Our model rationalizes observed patterns in CEO hiring and wages. We decompose managerial wage growth into contributions from general and firm-specific human capital accumulation, and job search. Beyond a level impact on wages, firm-specific human capital also impacts executive mobility (within and across jobs): as firm-specific skill increases, managers are less likely to switch firms, but are more likely to see upward revisions in the contract via search-driven renegotiation with their incumbent firm. This effect arises as firm-specific human capital increases the match-specific quality between the manager and firm over tenure.

Keywords: CEOs, the market for CEOs, executive pay, executive mobility, human capital accumulation, on-the-job search, structural estimation, firm-specific human capital

[*]This paper is a work in progress and results are subject to change, all errors our are own.

[†]Rice University Jones Graduate School of Business, john.w.barry@rice.edu
[‡]Warwick Business School, Noah.Lyman@wbs.ac.uk
[§]Duke University Fuqua School of Business, lin.zhao119@duke.edu

1. Introduction

How much of managerial human capital is general and how much is firm-specific? Knowing this split has important implications for understanding the executive labor market. Several of the prominent, prevailing theories explaining the rapid rise in CEO pay since the mid-1990s require executive skill that is general and portable across firms to rationalize their findings (e.g., Gabaix and Landier, 2008; Edmans et al., 2009; Murphy and Zabojnik, 2007).[1]

A key empirical prediction of these models is that executives move freely across firms. Yet, as shown in Cziraki and Jenter (2022), around 70% of new CEOs at the largest companies in the US are internally promoted, and only a small percentage of external hires are poached CEOs (Graham et al., 2020; Cziraki and Jenter, 2022).[2] In further evidence, Figure 1 displays average mobility and wage growth over CEO tenure. The pattern shows that, though CEO wages see strong positive growth over the first 10 years as CEO, the likelihood of a CEO switching firms decays quickly over the first years of tenure.

The observed preference for internal hires and low CEO mobility suggest that firm-specific human capital is a more important determinant of executive mobility and compensation than previously considered (Cziraki and Jenter, 2022). However, the impact of firm-specific capital in reducing the likelihood of outside hires is not immediately separable from an agency cost that induces a preference for insiders (He and Schroth, 2024), and firm-specific managerial skill must be measured relative to general skill in order to understand its full importance. Moreover, the low rate of CEOs taking their outside option (switching firms), along with high pay, suggest the CEO labor market is frictional and imperfectly competitive, and may more about splitting a surplus generated by the match between the CEO and firm (Cziraki and Jenter, 2022).

[1] Gabaix and Landier (2008) and Edmans et al. (2009) pose competitive assignment models that allow for complementarity between CEO skill and firm size, which thus helps explain the rise in CEO pay. Murphy and Zabojnik (2007), in a separate but related setting, shows that general managerial skill improves managers' outside options, which can also help rationalize the increase in CEO pay.

[2] Cziraki and Jenter (2022) show that 75% of new CEOs at S&P500 firms are internal hires from 1994-2012, and a large proportion of external hires are known to the Board (either a former executive, or a Board member). Graham et al. (2020) show that 68% of new CEOs are internal hires (a current or previous officer of the firm) for a fuller sample of NYSE/Amex firms from 1933-2011.

This paper's goal is to undertake a joint, quantitative analysis of mobility and wage growth over executive careers that incorporates these forces. We pose and estimate a job search model of executive careers with internal and external promotion, general and firm-specific human capital accumulation, executive bargaining power, and executive and firm heterogeneity. Unlike much of the existing literature which primarily examines firm demand for executive talent, we instead model the executive's career through the lens of a model of job search (Bagger et al., 2014), allowing for frictions in the labor market, bargaining between firms (and between firms and executives) over executive talent, and human capital accumulation.

Managers in the model may be employed as a (non-CEO) executive or as the CEO of the firm.[3] Over their careers, executives may receive job offers — to move horizontally, be promoted internally to CEO, or to be promoted externally to CEO; the arrival rates of these job offers differ and are estimated in the data. CEOs may receive job offers to be CEOs at other firms.

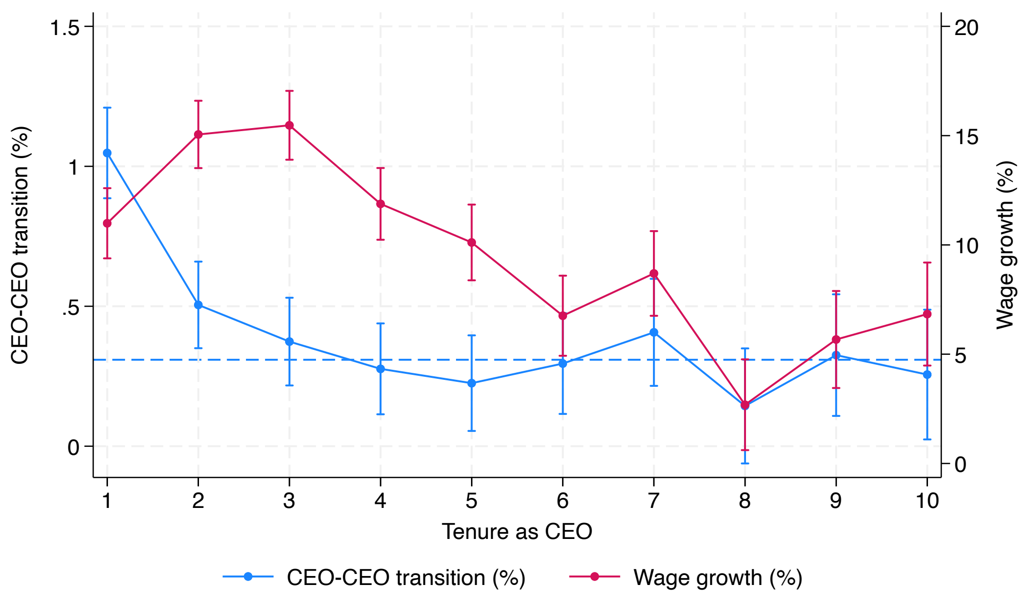
We follow an important strand of the search literature (Postel-Vinay and Robin, 2002; Cahuc et al., 2006; Bagger et al., 2014) and model wage contracts as piece-rate contracts: managers receive a portion $R \in [0, 1]$ of their contribution to firm output. When a manager receives an attractive outside offer, the incumbent and poaching firm may bargain over the executive's services (in the spirit of Rubinstein, 1982). Firm-switching events occur when the poaching firm values the manager more than the incumbent. On-the-job search leads to stochastic, discrete increases in pay via as firms bargaining over managerial services, even if the manager ultimately stays in their current position.

Our model is inspired most by Bagger et al. (2014). We adapt their setting to allow for firm-specific human capital (in addition to general) and for both external and internal promotion of executives. Importantly, we let search rates and executive bargaining power differ across internal and external promotion opportunities, which enables us to distinguish a preference for insiders (He and Schroth, 2024) from the impact of firm-specific human capital on internal *vs.* external executive mobility.

[3]Throughout the paper, in order to limit confusion, we refer to non-CEO executives as "executives" and CEOs as "CEOs"

Figure 1. CEO mobility and compensation growth across CEO tenure

This figure displays the estimated percentage of CEO-CEO transitions (left y-axis) and year-over-year wage growth (right y-axis) across tenure as CEO. All Execucomp CEOs with valid compensation (TDC1) and with a tenure lasting more than one year are included. CEOs that are promoted or externally hired start with tenure-as-CEO $\tau = 1$, and we display mobility (at end of τ) and wage growth (from τ to $\tau + 1$), starting at $\tau = 1$. Each regression includes CEO and firm fixed effects. The CEO-CEO transition rate is relative to the total number of CEOs of tenure τ, and the blue dashed line displays the unconditional transition rate (0.31%). CEO tenures lasting less than one year are excluded (likely interim CEOs).



While our main goal is empirical, the key theoretical insight from the model comes from the observation that firm-specific human capital accumulation leads to increased match-specific productivity between the firm and manage over the manager's tenure. This makes the manager less likely to be tempted away by poaching offers as they advance at the incumbent. We term this the "job lock effect" of firm-specific human capital — mobility (across firms) is dampened and managers are less likely to take up outside offers to improve their wage profiles.

However, to compensate for this decreased mobility, managers benefit from an "option value of renegotiation," the value the executive derives from contract renegotiation (fielding outside job offers which improve his current contract) *increases* across tenure. In short, firm-specific human capital increases the likelihood that the incumbent firm is willing to match attractive outside offers. As such, our model predicts less cross-firm mobility (job-hopping) and more within-firm mobility (contract renegotiation) as firm-specific human capital accumulates.

We estimate the model on a rich panel of executive careers spanning 1992-2023 (Execucomp), combined with manually-collected data on executive tenures at firms and their experience in the executive labor market. This allows us to track experience, tenure, compensation and mobility over an executive's entire career. Transitions of executives (non-CEO and CEO) across firms, and the resultant impacts on wages and mobility, allow us to separately identify general and firm-specific components of executive human capital.

Our estimation produces two key outcomes. First, we can decompose managerial human capital into its portable and firm-specific components. This is a standing open question in corporate governance and the answer has important consequences for the literature on executive compensation.

Second, we can decompose wage growth over executive careers into its key components: managerial bargaining power, general and firm-specific human capital accumulation, mobility effects (job-hopping), and contract renegotiation (upward revisions in wages caused by on-the-job search). Our model also allows us to study the impact of firm-specific skill (relative to general skill and also relative to any firm-side heterogeneity) on both mobility and contract renegotiation. As far as we know, no paper has jointly studied the impact of these forces on managerial wage profiles.

The paper is organized as follows. The rest of this section discusses the literature. Section 2 introduces our theoretical model and Section 3 discusses our estimation and identification strategies. Section 4 concludes. Model proofs and additional details are in Appendix A, and estimation details are contained in B.

1.1. Literature Review

Our paper lies in the intersection of the on-the-job search literature in labor economics, and the study of executives in corporate finance. On the labor side, our paper is closely related to preceding work concerning on-the-job search, bargaining, and human capital. Starting with Postel-Vinay and Robin (2002) and Cahuc et al. (2006), the authors develop and microfound a workhorse structural model of careers with on-the-job search. Bagger et al. (2014) continues by adding general human capital accumulation to the model (among other features), and study its effect on worker careers.

We expand these models in several key ways. First, we allow the worker to accumulate both general and firm-specific capital, and show that firm-specific skill has previously unstudied impacts on labor market mobility and renegotiation over worker careers.[4] Second, we allow the worker to possibly experience both internal and external mobility throughout their career, by allowing managers to be promoted to CEO at their current firm, as well as receive job offers to be CEO at other firms.

On the corporate finance side, the relative importance of general and firm-specific skill, or more specifically how this relative importance can explain CEO wage growth over time, has been extensively studied. Indeed, a large literature has arisen which stresses the importance of transferable executive skill in explaining the large observed increase in CEO wages over time.[5] However, to our knowledge, no paper has explicitly attempted to directly quantify the weights of general and firm-specific human capital in managerial skill.

Murphy and Zabojnik (2007) (and the related Murphy and Zabojnik, 2004) model the firm's choice of an internal *vs.* an external candidate, and show that, in a market with an elastic supply of executive labor, a larger importance on general executive skill (relative to firm-specific) can rationalize the observed increases in executive pay that have been observed in the data. As Custódio et al. (2013) point out, a direct implication of a competitive executive labor market is that firm-specific human capital receives a lower premium in wages, because firm-specific human capital does not improve the executive's outside option.

However, as pointed out by Cziraki and Jenter (2022), the labor market for CEOs (especially at large firms) seems to be highly frictional, with little movement of executives across firms as

[4]As pointed out by Lazear (2009) and Bagger et al. (2014), firm-specific human capital has received relatively less attention than general in the labor economics literature. However, firm-specific human capital is likely to be more important in the executive labor market, where, for example, fostering corporate culture (Graham et al., 2022), or efficiently deploying the firm's factors of production are important skills that may not transfer.

[5]This is a large, important recent literature in corporate finance, for example, Gabaix and Landier (2008); Terviö (2008); Edmans et al. (2009); Murphy and Zabojnik (2007); Custódio et al. (2013); Frydman (2019)

wages change and with executives rarely using their outside option; given these frictions, they suggest that the market for CEOs may involve firm-specific capital and frictions, in which the firm and CEO bargain to split the surplus generated by the match.

In a model of the executive labor market with on-the-job search, managerial bargaining power, in which incumbents and poachers compete for managerial talent, the above predictions of Murphy and Zabojnik (2007) and Custódio et al. (2013) are not necessarily true. While the manager's utilization of the outside option may decrease with tenure, the importance of the *renegotiation option*, in which managers use outside offers to improve their incumbent contract, become relatively more important.

Several papers have measured the importance of general and firm-specific skill in high-skilled industries (Gao et al., 2021; Ma et al., 2023). These papers allow the worker to accumulate human capital via learning-by-doing, and study how this shapes mobility choice across career. Our paper complements these studies by (i) focusing on the managerial labor market at US public companies more generally, and (ii) explicitly studying how firm-specific capital shapes mobility paths across careers.

2. Model

2.1. Environment

We consider a model of the managerial labor market consisting of a measure M of managers and a unit mass of firms. Time is continuous, with t denoting the labor market experience of a given manager. Managers may be employed in CEO or non-CEO positions, where we refer to the latter type of manager as an "executive." Employed CEOs and executives are compensated in proportion to their contribution to firm output: a manager's total compensation (in logs) is $w(p, t, \tau)$, where $p \in [p_{min}, p_{max}]$ is a position-specific match productivity parameter and τ denotes the manager's tenure at their firm. A manager acquires a new p any time they switch positions, and τ is reset to 0 any time a manager leaves their firm. Separations occur at rate η, in which case the manager enters a state of "unattachment." Managers retire and permanently leave the market at rate μ.

Production and human capital. Managers have both general and position-specific human capital, where a manager's total human capital (in logs) is given by:

$$h(t, \tau) = a + g(t) + k(\tau) \tag{1}$$

The parameter $a \sim N(0, \sigma_a^2)$ is an inherent manager-specific skill parameter reflecting permanent differences in individual ability. The functions $g(t)$ and $k(\tau)$ denote general and firm-specific human capital accumulated through work experience. General human capital $g(t)$ can be transferred across firms while position-specific human capital $k(\tau)$ cannot. In other words, if a manager enters unattachment or switches firms, $k(\tau)$ is reset to $k(0) = 0$.

Each manager-position match generates log output:

$$y(p, t, \tau) = p + h(t, \tau), \tag{2}$$

where $p \in [p_{min}, p_{max}]$ reflects position-specific match productivity. In our setup, firm-specific human capital increases the match-specific productivity $p + k(\tau)$ over the executive's tenure (Gao et al., 2021). As will be discussed later in this section, this increasing match productivity will influence how firms bargain over executives at different stages of tenure.

When a manager is not employed as an executive or CEO and is instead unattached, their tenure τ is fixed at zero and thus no firm-specific human capital accumulates. We allow experience to accumulate while in the unattachment state. The nature of the data on executive wages and mobility necessarily limits us to analyzing publicly-listed firms. Given the nature of the executive labor market, it is likely that unattached executives are accumulating experience, for example by managing a private firm or working in consulting. Upon entering (observable) managerial employment, a manager's tenure immediately begins to accumulate.

Retirement, unattachment and job search. All managers engage in on-the-job search and may make contact with a potential employer about a new position at any time. Whenever a manager makes contact about a potential position, that position's type p is drawn from the distribution $F(\cdot)$, with support $[p_{min}, p_{max}]$.

Differing levels of seniority impact the types of offers managers field. For executives, three possible offers may be received: internal promotion to CEO, external promotion to CEO, or a horizontal move to another executive position. Internal promotion opportunities arrive at rate λ_0. If a manager is considered for internal promotion, we assume that they draw a new position productivity p.[6] The key difference between internal and external mobility is that firm-specific human capital is preserved and continues to accumulate following an internal promotion.

External promotions arrive at rate λ_1. If accepted, the executive switches firms, takes the new CEO position of type p and their firm-specific capital resets to zero. Differences in the arrival rates of internal and external promotions (λ_0, λ_1) may reflect, for example, preferences (for or against) hiring CEOs within the firm or differences in firms' cost of internal and external search for executive talent. Lastly, offers for an executive position at a different firm arrive at rate λ_2. If such an offer arrives and is accepted, firm-specific human capital will again reset to zero.

For a manager employed as CEO, the only types of viable outside offers are for CEO positions at different firms; CEOs cannot be internally or externally demoted.[7] We assume that the arrival rate λ_1 is the same for both executives and CEOs. We will show however that despite this assumption, the rates of executive-to-CEO and CEO-to-CEO transitions will differ in equilibrium. As in the case for executives, if an outside offer is accepted, p is redrawn and $k(\tau)$ resets to zero.

When a manager sees their match dissolved, they enter a period of unattachment. While in the unattachment state, managers may receive offers for executive or CEO positions at rates γ_E and γ_C, respectively. Unattachment is not synonymous with unemployment. When unattached,

[6]This assumption captures the idea that for a given manager, their fitness for the CEO position may differ with that of another c-suite position. As explained below, when evaluating a promotion opportunity, the executive and firm will internalize this difference in productivity when they begin to bargain.

[7]This assumption is motivated by the data. When examining potential demotions (when a manager is the CEO at a firm in year t and a non-CEO executive in year $t + 1$) in our data, we find that a large majority comprise advisory positions. For example, the previous CEO stays on at the firm explicitly as an advisor to the current CEO, or implicitly by taking chairmanship of the board. However, a small number of true demotions do exist in our data. Our model is not intended to study the decision to promote a (possibly interim) CEO and subsequently demote them, so we remove these managerial spells from our estimation sample.

managers have no pecuniary tie to any publicly-held firm, but may still seek employment in the government or private sector, for example. Explicitly modeling these alternative labor markets is beyond the scope of this paper, and we emphasize that the important point for our purposes is that while unattached, managers accumulate no human capital specific to any publicly-held firm in our sample.

2.2. Bargaining and Wage Contracts

Wages are modeled as piece-rate contracts in which managers receive an endogenous share $R \in (0, 1]$ of their marginal product (Postel-Vinay and Robin, 2002; Cahuc et al., 2006; Bagger et al., 2014). Specifically, the level of compensation $W(p; t, \tau)$ is given by:

$$W(p; t, \tau) = Re^{y(p,t,\tau)}$$

or in log form:

$$w(p, t, \tau) = r + p + h(t, \tau) = r + p + a + k(\tau) + g(t) \tag{3}$$

Piece rates $r = \log(R) \leq 0$ are determined via Nash bargaining where $r = 0$ captures the extreme case in which the manager fully extracts the surplus generated by the position. For a manager with experience t, tenure τ, and match productivity p under a contract stipulating piece rate r, we denote the discounted value of their position by $V_i(r, h, k, p)$, for $i \in \{E, C\}$.[8]

Over their careers, managers leverage competing offers to increase the values of their current positions (through renegotiation) or transition into more valuable positions. When a job offer arrives, a bargaining game is initiated between the manager and firm(s) bidding for their services.

The bargaining protocol can be seen as an extension of that found in Cahuc et al. (2006), which we provide microfoundations for in Appendix A. First, we relax the assumption of perfect tranferability of human capital, and show that this has key implications for wage trajectories and employment transition probabilities in equilibrium. Second, our bargaining game is complicated

[8]Experience t is kept implicit in the state to reduce notational clutter. Additionally, including $k(\tau)$ in the state is equivalent to including τ, as $k(\tau)$ is sufficient for τ.

by the fact that over their careers, managers may receive offers for both executive and CEO positions. This introduces a set of trade-offs across position types which managers must consider as they climb the job ladder, and allows us to make theoretical predictions about the dependence of CEO pay on prior employment histories. We begin this discussion by next describing the bargaining protocol determining the evolution of the piece rate r.

2.2.1. Managerial Bargaining

Our model entails three different forms of bargaining. Non-CEO executives can be promoted to CEO internally or receive external offers to be CEO. Both executives and CEOs can receive horizontal offers. We detail each of these bargaining protocols in turn.

Internal promotions. Consider an executive with state (r, h, k, p) and suppose their firm approaches them offering to promote them to CEO. The executive's position productivity for the CEO role p' is drawn from the distribution $F(\cdot)$; p' can greater or smaller than p, reflecting that managers are more or less productive within different roles at the same firm.

The new match productivity p' may be low enough that the manager and firm pass on the promotion and the executive stays in their current role. Otherwise, the firm and executive bargain and the outcome is a piece rate r' which satisfies the following condition:

$$
\begin{aligned}
V_C(r', h, k, p') &= V_E(r, h, k, p) + \beta_0 \left[V_C(0, h, k, p') - V_E(r, h, k, p) \right] \\
&= \beta_0 V_C(0, h, k, p') + (1 - \beta_0) V_E(r, h, k, p) \qquad (4)
\end{aligned}
$$

The value to the manager of accepting the internal promotion is the value of the current match plus a share β_0 of the additional rents arising out of the new position. The parameter β_0, to be estimated, measures managers' internal bargaining power.

Note that the sharing rule implies that it is in the executive's interest to accept the promotion to CEO if and only if $V_C(0, h, k, p') > V_E(r, h, k, p)$. It will be useful to define $\bar{\theta}(r, h, k, p)$ as the critical level of match productivity such that the manager would accept an internal promotion:

$$V_C(0, h, k, \bar{\theta}(r, h, k, p)) = V_E(r, h, k, p) \tag{5}$$

Given an executive with state (r, h, k, p), if $p' \geq \bar{\theta}(r, h, k, p)$, the executive accepts the CEO role under the wage contract defining (4). Otherwise, if $p' < \bar{\theta}(r, h, k, p)$, the executive and firm halt their negotiations and the executive remains in their current position. We assume that $\bar{\theta}(p_{min}) = p_{min}$, in which case the following result holds:

Theorem 1. $\bar{\theta}(r, k, p) \leq p$.

Proof. See Appendix A. ∎

This result shows that executives are willing to accept a promotion to CEO, even if it entails sacrificing some amount of match productivity. This follows from the structure of the managerial job ladder. Executives have more opportunity to climb the job ladder than CEOs, who have already made it to the top. In equilibrium, CEO positions are associated with lower rates of turnover than executive positions as a result. As such, CEO employment is more valuable than executive employment, all else equal, by virtue of the fact that expected lengths of employment are longer for CEOs. It therefore may be beneficial for an executive to accept a promotion to CEO even if this entails moving into a position for which they are relatively less qualified.

External promotions. Next, consider an executive with state (r, h, k, p) who is approached by a poaching firm with an offer to serve as CEO. Again, a match-productivity p' is drawn and the manager, their current firm, and the poaching firm initiate a bargaining game. Relative to the case of internal offers, managers find themselves in more favorable bargaining positions upon the arrival of external offers, as they can pit their current and poaching firm against one another (Cahuc et al., 2006). Such competition over the their services has a positive effect on the manager's threat point. We show in Appendix A that if $p' > \bar{\theta}(r, h, k, p) + k(\tau)$, the manager accepts the external promotion under a piece rate r' satisfying:

$$V_C(r', h, 0, p') = \beta_1 V_C(0, h, 0, p') + (1 - \beta_1) V_E(0, h, k, p) \tag{6}$$

where β_1 measures managers' external bargaining power, which we do not restrict to equal β_0. Notice that given the same state (r, h, k, p), the minimum level of productivity required to accept an external CEO position is larger than that of an internal CEO position. This arises by virtue of the fact that firm-specific capital causes the match-specific productivity to increase over tenure: $k(\tau)$ is not transferable across firms and upon accepting an offer with a new firm, k resets to zero. The match productivity associated with the new position (p') must be large enough to compensate for this lost firm-specific human capital. If $p' < \bar{\theta}(r, h, k, p) + k_{-}$, where k_{-} denotes the executive's firm-specific human capital at their current firm just before the offer arrives, the poacher cannot successfully hire the executive. Despite this, the manager may still use this poaching offer as leverage and renegotiate their pay contract with the incumbent firm. Namely, if $p' < \bar{\theta}(r, h, k, p) + k$, the incumbent firm retains the manager by adjusting their piece rate according to:

$$V_E(r', h, k, p) = \beta_1 V_E(0, h, k, p) + (1 - \beta_1) V_C(0, h, 0, p') \tag{7}$$

Though a given offer may not be attractive enough for the manager to accept in equilibrium, the *threat* of acceptance triggers a bidding war between the poaching and incumbent firms, ultimately increasing the manager's piece rate. Importantly, an outside offer for a CEO appointment may be so unattractive as to not trigger a change in the current piece rate r. We denote $\underline{\theta}_O$ as the minimum level of productivity which triggers a piece rate renegotiation:

$$V_E(r, h, k, p) = \beta_1 V_E(0, h, k, p) + (1 - \beta_1) V_C(0, h, 0, \underline{\theta}_O) \tag{8}$$

Horizontal Moves. Finally, managers can receive offers to serve in an equivalent role at another firm, which we refer to as a "horizontal" move. The bargaining protocol works largely the same as in the previous case. It is in fact a bit simpler, as there is no trade-off between position types. Consider a manager in position type $i \in \{E, C\}$ with state (r, h, k, p) who is approached by a poaching firm with an offer to serve in an equivalent role. A new match-productivity p' is drawn the manager, their current firm, and the poaching firm begin bargaining. If $p' > p + k$, the manager accepts the executive role with the poaching firm under r' satisfying:

$$V_i(r', h, 0, p') = \beta_1 V_i(0, h, 0, p') + (1 - \beta_1) V_i(0, h, k, p) \quad \text{for } i \in \{E, C\} \tag{9}$$

Conversely, if $p' \leq p + k$, the incumbent firm retains the manager by offering a new piece rate satisfying:

$$V_i(r', h, k, p) = \beta_1 V_i(0, h, k, p) + (1 - \beta_1) V_i(0, h, 0, p') \quad \text{for } i \in \{E, C\} \tag{10}$$

As before, competing offers may be so unattractive as to not induce any renegotiations with the manager's current employer. Define the minimum level of productivity which triggers a renegotiation as:

$$V_i(r, h, \tau, p) = \beta_1 V_i(0, h, \tau, p) + (1 - \beta_1) V_i(0, h, 0, \underline{\theta}_i) \quad \text{for } i \in \{E, C\} \tag{11}$$

2.2.2. Unattached Managers

When unattached, managers can receive an executive or CEO job offer (with rates γ_E and γ_C). We assume throughout the paper that the value of being unattached is equivalent to employment in the least-productive executive position, $V_U(h) = V_E(0, h, 0, p_{min})$. As in Bagger et al. (2014), this convenient assumption means that the unattached manager accepts any job offer.

2.3. Value Functions

We assume that managers have logarithmic flow utility and that there is no transfer of wealth across time. All parties discount the future at rate ρ. Let $S(\cdot) = 1 - F(\cdot)$ be the survivor function for the distribution of position types. Given the threshold position $\underline{\theta}$ which leads to no contract revision, $S(\underline{\theta})$ represents the fraction of positions for which the manager simply discards the job offer.

CEOs have the value function:

$$\begin{aligned}\left(\rho + \mu + \eta + \lambda_1 S\left(\underline{\theta_C}\right)\right) V_C(r, h, k, p) = \;& w + \eta V_U(h) + \\ & \lambda_1 \int_{p+k}^{p_{max}} \mathbb{E}\left\{(1-\beta_1)V_C(0, h, k, p) + \beta_1 V_C(0, h', 0, x)\right\} dF(x) + \\ & \lambda_1 \int_{\underline{\theta_C}}^{p+k} \mathbb{E}\left\{(1-\beta_1)V_C(0, h', 0, x) + \beta_1 V_C(0, h, k, p)\right\} dF(x)\end{aligned} \tag{12}$$

The net present value of holding a CEO position is the sum of flow compensation and expectations over future employment transitions. Note that the integral terms in the value function above reflect the structure of the CEO bargaining process. If a poaching offer with $p' > p + k$ arrives, the CEO transitions to the poaching firm and receives a piece rate satisfying Equation (9). If a poaching offer with $p' \in \{\underline{\theta_C}, p + k\}$ arrives, the CEO remains with their current firm at a renegotiated rate defined by Equation (10). Lastly, if $p' < \underline{\theta_C}$, the poaching offer is discarded and nothing happens. The net present value of holding an executive position, though slightly more cumbersome, is similar in structure:

$$\left(\rho + \mu + \eta + \sum_{s=0}^{2} \lambda_s S\left(\underline{\theta_s}\right)\right) V_E(r, h, k, p) = \; w + \eta V_U(h) +$$

$$
\begin{aligned}
&\lambda_0 \int_{\bar{\theta}}^{p_{max}} \quad \mathbb{E}\Big\{(1-\beta_0)V_E(0,h,k,p) + \beta_0 V_C(0,h,k,x)\Big\}\, dF(x) + \\
&\lambda_1 \int_{\bar{\theta}+k}^{p_{max}} \mathbb{E}\Big\{(1-\beta_1)V_E(0,h',k',p) + \beta_1 V_C(0,h',0,x)\Big\}\, dF(x) + \\
&\lambda_1 \int_{\underline{\theta}_O}^{\bar{\theta}+k} \mathbb{E}\Big\{(1-\beta_1)V_C(0,h',0,x) + \beta_1 V_E(0,h',k',p)\Big\}\, dF(x) + \\
&\lambda_2 \int_{p+k}^{p_{max}} \mathbb{E}\Bigg\{(1-\beta_1)V_E(0,h',k',p) + \beta_1 V_E(0,h',0,x)\Bigg\}\, dF(x) + \\
&\lambda_2 \int_{\underline{\theta_2}}^{p+k} \mathbb{E}\Big\{(1-\beta_1)V_E(0,h',0,x) + \beta_1 V_E(0,h',k',p)\Big\}\, dF(x)
\end{aligned}
\tag{13}
$$

2.4. Equilibrium Contracts

We next summarize the equilibrium piece rate contracts, paying special attention to how the transferability of human capital across firms impacts managerial wage growth and mobility. We begin by analyzing how the executive contract differs across the mobility events over an executive's career. That is, how does the contract look when an executive has accepted a new position, and what forces within the model drive differences in executive surplus capture across different career events.

2.4.1. The CEO contract

We define the CEO's piece rate by the function $r_C(p, k, \underline{\theta_C})$, which depends on the CEO's current position productivity, their level of firm-specific human capital, and the threshold match quality $\underline{\theta_C}$ which tracks the last match quality from which the CEO captured the full surplus in the bargaining game. Contracts are restructured only in the event of a competing offer. Depending on the match productivity associated with the competing offer, three possibilities may be realized. First, if $p' > p + k$, the manager accepts the offer and vacates their current position. Second, if $p' \in \left[\underline{\theta_C}, p + k\right]$, the manager remains in their current position contingent on renegotiating the terms of their contract. Finally, if $p' < \underline{\theta_C}$, the CEO discards the offer and the contractual terms remain unchanged. We begin by analyzing transitions of employment, in which case $p' > p + k$.

Mobility. We adopt the following terminology when describing different types of CEO transitions: *horizontal* moves refer to across-firm CEO to CEO transitions, *diagonal* moves refer to across-firm executive to CEO transitions, and *vertical* moves refer to within-firm executive to CEO transitions. We begin by analyzing the case of horizontal CEO transitions. Consider a CEO employed in a p position who is poached into a p' position. Denote by k_{-} the CEO's level of firm-specific human capital just before leaving their previous firm. The initial piece rate in their new position is given by:

$$r_C^{hor}(p', 0, p + k_{-}) = -(1 - \beta_1) \int_{p+k_{-}}^{p'} q(x)\, dx \tag{14}$$

where

$$q(x) = \frac{\rho + \mu + \eta + \lambda_1 \bar{F}(x)}{\rho + \mu + \eta + \lambda_1 \beta_1 \bar{F}(x)}$$

This expression resembles the piece rate from Bagger et al. (2014) with the subtle difference given by its dependence on k_{-}. With imperfect transferability of human capital, the CEO's firm-specific capital in their previous position has no direct impact on output in their new position yet still directly impacts the structure of compensation. Namely, the new piece rate increases with respect to the CEO's tenure in their previous position. Thus, long-tenured CEOs with high levels of firm-specific proficiency are more expensive to poach than their newly-tenure counterparts.

Consider next an executive in a p position who is externally promoted into a p'-productivity CEO position. Their initial piece rate is given by:

$$r_C^{diag}(p', 0, p + k_{-}) = r_C^{hor}(p', 0, p' + k_{-}) - (1 - \beta_1) \int_{\bar{\theta}(p)+k_{-}}^{p+k_{-}} q(x) dx \tag{15}$$

Theorem 1 implies that the second term in Equation (15) is strictly positive. Hence, when considering externally-hired CEOs, those appointed from executive positions are initially paid less than those appointed from CEO positions (all else equal). This pay gap reflects differences in outside options between these two types of CEOs at the time of the wage negotiation. Simply put, because executive positions are less valuable sources of employment than CEO positions, it is cheaper for firms to successfully poach an executive than a CEO.

Finally, consider an executive in a p position who is internally promoted into a p' CEO position. The initial piece rate is given by:

$$r_C^{vert}(p', 0, p' + k_-) = r_C^{diag}(p', 0, p' + k_-) - (1 - \beta_1) \int_{p'}^{p'+k_-} q(x) dx \\ + (\beta_0 - \beta_1) \int_{\tilde{\theta}(p)+k_-}^{p'} \frac{\rho + \mu + \eta}{\rho + \mu + \eta + \lambda_1 \beta_1 \bar{F}(x)} dx \tag{16}$$

When comparing vertical and diagonal promotions to CEO, the above condition highlights the mechanisms yielding disparities in their initial pay contracts. First, as vertically-promoted CEOs retain their accumulated firm-specific human capital upon accepting the promotion, firms do not need to offer as much surplus in order to win their services (reflected in the second term in the equation above). Additionally, the two types of CEOs command different levels of bargaining power, and as such will systematically receive different levels of pay. The relative level of $r_C^{vert}(p', 0, p' + k_-)$ and $r_C^{diag}(p', 0, p' + k_-)$ in general depends on the relative levels of bargaining power between the two CEO types, and as such must be resolved empirically.

Renegotiation. Next, we analyze the effect of outside CEO offers with match productivity $p' \in \left[\underline{\theta_C}(p, k), p + k\right]$, in which case managers are retained by contracts are renegotiated. We refer to the set $\left[\underline{\theta_C}(p, k), p + k\right]$ as the *renegotiation region*, the size of which is dependent on CEO type. This represents the set of competing positions which, while not lucrative enough for the CEO to accept, would provide the CEO with some leverage over their current employer in the event of an offer arriving. Upon receiving an outside offer with productivity p' in this range, the renegotiated piece rate will be:

$$r_C(p, k, p') = -(1 - \beta_1) \int_{p'}^{p+k} q(x) \, dx \tag{17}$$

Of course, it is in the CEO's interest to discard offers which would yield negative piece rate revisions following from renegotiations with their employer. In order to trigger a renegotiation, a competing offer must have productivity exceeding $\underline{\theta_C}(p, k)$, as defined in Equation (11). $\underline{\theta_C}(p, k)$ defines the lower boundary of the CEO's renegotiation set, whose dynamics are summarized in the following theorem:

Theorem 2. *Define $\Omega_r^m(p, k)$ as the mass of the renegotiation region for each $m \in \{hor, diag, vert\}$. For all m:*

$$\frac{\partial \Omega_r^m}{\partial k}(p, k) > 0 \tag{18}$$

That is, the renegotiation region grows in size as firm-specific human capital accumulates. Additionally, given a value of p, we have for all k:

$$\Omega_r^{vert}(p, k) > \Omega_r^{diag}(p, k) > \Omega_r^{hor}(p, k) \tag{19}$$

Proof. See Appendix A. ■

The above result has important empirical implications. First, as k grows with CEO tenure, the probability of an employment transition gradually declines. CEOs experience a growing degree of "job lock;" because switching positions entails sacrificing their firm-specific human capital, CEOs grow increasingly willing to remain in their current position as opposed to seeking employment elsewhere. However, the probability of contractual renegotiations grows with tenure, as the mass of the renegotiation region is increasing. By virtue of firm-specific human capital accumulation, CEOs grow increasingly valuable to their employers with tenure. Their employers are thus increasingly willing to concede favorable renegotiations to the CEO's terms of contract as not to lose them to a competing firm.

Moreover, the likelihood of favorable renegotiation varies by CEO type. As vertically-hired CEOs retain their firm-specific human capital upon promotion, they are the most valuable of the three types for a given level of p. Thus, these types hold an especially high amount of leverage over their employers, and should see relatively higher rates of renegotiation. Horizontally-hired CEOs, who bring no firm-specific human capital to the table and are relatively expensive to hire, are the least likely to see favorable renegotiations conceded from their employer. Diagonally-hired CEOs, who also begin employment with no firm-specific human capital but are cheaper to hire than horizontal CEOs, lie somewhere in between the two extremes.

2.4.2. The executive contract

Our model also admits a definition for the executive piece rate, which tracks how vertical (internal CEO promotion), diagonal (external CEO promotion) and horizontal (external executive) opportunities impact the executive contract throughout their careers and tenures.

Analyzing executive (not just CEO) contracting is important theoretically, because it allows us to model directly internal promotions. Further, when we undertake the estimation, executive-to-executive transitions will be important for separately identifying general and firm-specific human capital.

Despite this, analyzing the executive contract in detail is less important than the CEO contract from a prediction perspective. Nevertheless, we show in Appendix A that the executive piece rate, upon switching to a p' position from a p position with k_- firm-specific human capital can be written as:

$$r_E(p', 0, p + k_-) = -(1 - \beta_1)\Bigg\{ \int_{p+k_-}^{p'} q_E(x)\, dx \\ - \lambda_0\beta_0 \int_{\bar{\theta}(p)}^{\bar{\theta}(p')} \phi_C(x)S(x)\, dx + \lambda_1(1 - \beta_1) \int_{\bar{\theta}(p)+k_-}^{\bar{\theta}(p')} \phi_C(x)S(x)\, dx \Bigg\} \tag{20}$$

where

$$q_E(x) = \frac{\rho + \mu + \eta + \lambda_0\beta_0 S(\bar{\theta}(x)) + \lambda_1\beta_1 S(x) + \lambda_2 S(x)}{\rho + \mu + \eta + \lambda_0\beta_0 S(\bar{\theta}(x)) + \lambda_1\beta_1 S(x) + \lambda_2\beta_1 S(x)}$$

$$\phi_C(x) = \frac{1}{\rho + \mu + \eta + \lambda_1\beta_1 S(x)} = \frac{\partial V_C}{\partial x}(0, h, 0, x)$$

The first line is the executive-equivalent to the CEO piece rate, and reflects the impact of horizontal mobility on the executive contract. Where the executive contract differs is in how *promotion opportunities*, both internal and external impact the executive's contract.[9]

2.4.3. The managerial wage process

The analysis above on contracting in our model gives the empirical wage processes for managers (for $j \in \{E, C\}$):

$$w_j(p, t, \tau) = \alpha + \varepsilon(t) + g(t) + k(\tau) + p + r_j\Big(p, k(\tau), \underline{\theta_j}\Big) \tag{21}$$

We can use (21) to write the model's wage growth process over the manager's career, which allows us to decompose wage growth into its various pieces. First, consider managers (both executives and CEOs, $j \in \{E, C\}$ who do not enter a state of unattachment and denote p' as the (potential) draw for a new position from search. The variable $\underline{\theta_j}'$ tracks the possible new threshold threshold position productivity for which the manager would capture the full surplus, and the variable $\underline{\theta_j}$ (implicitly a function of p and τ) tracks the current threshold productivity. Conditional on the manager remaining in their current state of employment (executive or CEO employment)[10], the managerial wage growth process is

$$\begin{aligned} dw_j(p, t, \tau) = & \underbrace{dg(t)}_{\text{General human capital accumulation}} + \\ & \underbrace{dk(\tau)\, dN_t\Big(1 - \lambda_j F(p + k(\tau))\Big)}_{\text{Firm-specific human capital accumulation}} + \\ & \underbrace{\left(r_j\Big(p, k(\tau), \underline{\theta_j}'\Big) - r_j\Big(p, k(\tau), \underline{\theta_j}\Big)\right) dN_t\bigg(\lambda_j\Big(F(p + k(\tau)) - F(\underline{\theta_j})\Big)\bigg)}_{\text{Contract renegotiation}} + \end{aligned}$$

[9]In Appendix A, we derive the mass of the renegotiation region for the executive and compare it to that of the CEO. We note that it leads to similar predictions as the CEO equivalent.

[10]Eq. (22) is not intended to make statements about transitions across employment states. It is not relevant when a manger switches to unattachment, nor does it make predictions about executive promotions to CEO.

$$\underbrace{\left(p' - (p + k(\tau)) + r_j\Big(p, 0, p + k(\tau)\Big) - r_j(p, k(\tau), \underline{\theta_j})\right) dN_t\Big(\lambda_j S(p + k(\tau))\Big)}_{\text{Job-hopping}} \tag{22}$$

where $dN_t(x)$ is a Poisson process with arrival rate x.[11]

Eq. 22 is a key equation of the paper. The first line tells us the impact of general human capital accumulation on wage growth, the portion of human capital that stays with the manager across their career. The second line tracks firm-specific human capital accumulation (note that firm-specific human capital will accumulate in all states when the manager does not switch firms). The third line tracks the impact of job-hopping: managers taking up other positions over their career (where we incorporate the loss of firm-specific capital in this event). The last line tracks the impact of on-the-job search on managerial wages over their career — job offers that lead to contract renegotiation, but ultimately do not induce the CEO to switch firms.

The empirical value of this equation is apparent. The relative importance of the components of human capital is largely unobservable in the data. Further, any impact of search on contract renegotiation is also unobservable.

2.5. Model predictions

Our model makes several predictions about the impact of firm-specific human capital executives wages and mobility. While the estimation results will ultimately reveal the importance of firm-specific capital, illustrating these predictions is useful for summarizing the theoretical results from the model and guiding the estimation.

Prediction 1. *Firm-specific human capital makes it less likely that a manager leaves their current firm, i.e. mobility across firms decreases.*

[11] Conditional on remaining employed, two events may lead to a job-hob or a contract renegotiation. These events arrive with intensity $\lambda_j\left[F(p + k(\tau)) - F(\underline{\theta_C})\right]$ and $\lambda_j[S(p + k(\tau))]$, respectively. Note that job-hopping discretely impacts a CEO's stock of firm-specific capital, so with complementary intensity (relative to job-hopping), the CEO continues to accumulate human capital.

This prediction immediately follows from the upper bounds of the renegotiation region for external mobility events; for both CEOs and executives, this upper threshold is increasing in k. The evidence in Cziraki and Jenter (2022) suggests that firm-specific human capital plays a larger role in the market for CEOs than previously thought. Our model delivers the prediction that it plays an important role in determining the cross-firm mobility of executives.

Prediction 2. *Firm-specific human capital makes it more likely that a manager receives a job offer that leads to a renegotiation at their current firm, i.e. mobility within-firm increases.*

This prediction follows directly from Theorem 2, which shows that the renegotiation region grows as firm-specific human capital accumulates. A direct implication of this prediction, given (22), is that contract renegotiation plays a more important role (at least on the extensive margin) in wage growth than job-hopping as firm-specific capital accumulates. While the market for managers implies that job-switching is relatively rarer given firm-specific skill, it *does* imply that on-the-job search and market forces can induce positive changes in wages via managers bargaining with their current firm, and firm-specific human capital plays an important role in this process.

Prediction 3. *The impact of on-the-job search for CEOs is path-dependent, and depends on whether executives are promoted internally, promoted externally, or horizontally poached.*

A subtle follow-on implication of Theorem 2 is that on-the-job search has different implications for depending on how the CEO was hired. In particularly, the renegotiation region (given productivity p) is always the largest for vertically-promoted CEOs. This is exactly because firm-specific skill survives the internal promotion process. While horizontally poached CEO-to-CEO transitions are generally more expensive (firms must compensate the CEO for non-transferable firm-specific skill), they also are the least likely to see renegotiations arising from firm-specific capital.

Prediction 4. *Holding all else equal, including the position productivity p, poached CEOs garner the most favorable contracts. The difference in contracts for diagonally- and vertically-hired CEOs* *will depend on the relative magnitude of internal and external managerial bargaining power.*

This prediction concerns the search-driven bargaining power of newly-hired CEOs. Poached CEOs require the largest piece rates to tempt them from their current positions. In order to compensate CEOs for the value lost from giving up their firm-specific skill, the contracts must be larger. Our estimation will reveal the the contracting differences between diagonally-poached and vertically-promoted CEOs.

3. Estimation

We estimate the model via indirect inference (Smith, 2016).[12] Appendix B details the estimation algorithm and the majority of this section is devoted to our identification strategy.

3.1. Model solution and simulation

The set of managerial contracts described in Section 2.4 provide a full characterization of the data generating process. For any manager (executive or CEO), the equilibrium sharing rules and the wage equation (21) describe how executive wages evolve across experience, tenure, and the possibly mobility events in our model.

To simulate the model, we start with an initial cross-section of I managers at time 0, and assign them an ability $a \sim N(0, \sigma_a^2)$, and then subsequently assign them to executive and CEO positions based on the rates γ_E and γ_C as if they come from unattachment. For each employed manager, we draw an initial p productivity and assume that the lower bound for renegotiation is p_{min} upon birth. As in Bagger et al. (2014), we discretize the productivity grid into P points and assign each point a weight according to the density function of the underlying Weibull distribution.

From there, labor market events (in/out of unattachment, mobility) arrive at the relevant rates for each manager at any given time. For each job offer, a position productivity p' is drawn and

[12] Indirect inference is a simulated method of moments estimator which involves fitting an auxiliary model that incorporates parameters from (potentially misspecified) reduced-form econometric models. This approach entails comparing the parameters of the auxiliary model fitted on both observed and simulated data to find the vector of structural parameters that minimizes the distance between them. Indirect inferences generates consistent estimates of the economic model by mapping the parameters of the structural (economic) model to the parameters of the auxiliary model.

the piece rate is updated given the relevant labor market outcome (job-switch, renegotiation, no change). Retired managers are replenished at the rate μ to keep the stock of managers (in CEO and executive positions) steady across time. Depending on the job offer (or if none arrives), the lower bounds for renegotiation and piece rates are updated. Human capital accumulates over time and contributes to changes in wages.

We simulate the model for 80 years, and use the first 50 years as "burn-in" to allow the economy to approach steady-state.[13] Once a worker reaches 45 years of experience, we force retirement. As such, we are left with a panel data with 30 years of data and a cross-section of managers, which allows for accurate comparison with the data moments.

3.2. Identification Strategy

We show there is a tight relation between the reduced-form outcomes of the auxiliary model and structural parameters, which is key to the success of the indirect inference approach. We have four sets of "moments" which target different sets of structural parameters, and our identification argument is inspired by key papers in the structural search and human capital literature (e.g., Cahuc et al., 2006; Bagger et al., 2014).

3.2.1. Executive Labor Market Mobility

The model entails three types of (un)employment: unattachment, executive employment and CEO employment. We allow all conditional transition probabilities (from employment to unattachment) to vary by tenure. In particular, we condition on managers in the first five years of tenure at their current firm (or later) when calculating the empirical moments that identify labor market mobility, which is empirically motivated.

Managers retire/die at rate μ_τ for any employment type. In the data, if a manager transitions

[13]Structural papers in the search literature often derive the steady-state distributions and use that to simulate economies. While an analytical description of the steady-state of our model may exist, it requires full derivations of, for example, the conditional distribution of position types p and job types E, C given both experience and tenure, the conditional distribution of tenure given experience, and a conditional distribution of piece rates (renegotiation thresholds) given position-type, job-type and tenure. As our ultimate goal is empirical, we prefer to let the simulation arrive to steady-state.

out of their current position and does not appear in the data again, we assume retirement. The parameters μ_τ is identified by the the empirical probabilities that an employed manager (executive or CEO) enters retirement (conditional on tenure). The parameters η_τ is identified by the same for employed managers entering unattachment. We replenish the economy with new unattached managers (experience and tenure of 0) to match the unconditional retirement rate μ

Unattached managers can become an executive, a CEO or stay unattached. The rates γ_E and γ_C capture the likelihood of these events. These are identified by the empirical probabilities of an unattached manager entering executive or CEO employment from unattachment.

Executives (i.e., non-CEOs) can experience 3 mobility events at any given point (excluding entering unattachment or retirement). They can be promoted to CEO at their current firm ($\lambda_0(\tau)$), become CEO at another firm ($\lambda_1(\tau)$), move horizontally ($\lambda_2(\tau)$). These are identified by the early- and later-tenure empirical probabilities of these events happening to executives. Similarly for CEOs, they can only experience one mobility event: $\lambda_1(\tau)$. Thus, the parameter $\lambda_1(\tau)$ is identified by both the executive and CEO probability of leaving their firm to be CEO at another.

3.2.2. Mincer Wage Regressions

For the full sample of managers in executive or CEO employment, we estimate a Mincer wage equation. That is we run the regression, for firm i, position j (non-CEO vs CEO), executive s and year t

$$w_{ijst} = \sum_{q=1}^{Q} \left(a_q \tau_{ist}^q + b_q t_{st}^q \right) + \delta_{prom} \times \text{Prom}_{ijst} + \delta_{move} \text{Move}_{ijst} + \gamma_{ij} + \phi_s + u_{ijst} \tag{23}$$

The tenure and experience polynomials are useful for identifying the $g(t)$ and $k(\tau)$ functions and variation in wages across resets of tenure within executive careers (holding experience fixed) are especially useful for separating out firm-specific human capital.

The position (CEO vs. non-CEO) $\times$ firm fixed effect γ_{ij} helps identify the position productivity distributions. As in Bagger et al. (2014), we assume a Weibull distribution for productivity in the model, which requires a location p_{min}, a scale and a shape parameter (s_{j1} and s_{j2}), where

$F_j(p) = 1 - \exp\left(-[s_{j1}(p - p_{min}]^{s_{j2}}\right)$.[14] We winsorize γ_{ij} at the 0.05 percentile and include the first four moments of the distribution, by position. The volatilities of the manager-specific fixed effect and the residual help pin down variation in managerial ability and the human capital idiosyncratic shock. To help pin down the AR1 coefficient in the human capital shock, we include as a moment the autocorrelation in u_{ijt} for executives with at least eight years of consecutive experience.

Note that we do not estimate different productivity-type distributions for executive and CEO positions. However, targeting different *conditional* distributions in the data is useful for identification. This is because differences in productivity arise endogenously for executives and CEOs solely through the types of job opportunities they receive throughout their career.

The coefficients δ_{prob} and δ_{move} identify the bargaining power parameters β_0 and β_1. To see this, for executive s, let $N_s(t)$ denote the number of positions s has held up until time t, and similarly let $I_s^0(t)$ denote whether the manager was internally promoted to CEO at time t, and let $N_s^1(t)$ and $N_s^2(t)$ denote the number of external movements at time t (to CEO and to executive, respectively). The executive's current piece rate can be written as:

$$\begin{aligned}
r_s(N_s(t)) &= r_s(0) + \sum_{i=1}^{N_j(t)} \overbrace{(r_s(i) - r_s(i-1))}^{\delta_{is}(\beta_0,\beta_1)} \\
&= r_s(0) + I_s^0(t)\delta_{is}(\beta_0) + \sum_{j=1}^{N_s^1(t)} \delta_{js}(\beta_1) + \sum_{k=1}^{N_s^2(t)} \delta_{ks}(\beta_1)
\end{aligned}$$

As such, including indicators for whether the CEO was internally promoted (time t or later), and the first period an executive switches jobs identify the bargaining power parameters β_0 and β_1.

3.2.3. Within- and Across-Job Wage Growth

We also consider how experience and tenure separately impact wage growth of executive careers. We condition only that a manager have two consecutive years of experience to be included in this regression. However, to isolate the impacts of firm-specific human capital on wage growth, we

[14]The Weibull distribution is appropriate for modeling position-types, as it allows for excess skewness and kurtosis. Given the empirical distribution of executive wages, this is a convenient feature relative to a Normal distribution.

separately study the impacts of experience on tenure, within-job and across mobility events.

Specifically, We define an event-study sample and to focus on when executives change firms. That is, in a 3-year window around the event (so, a maximum of seven years of data per manager, and a minimum of two years experience at either firm in the years before and after the switch), we focus on how changes in wages differ in mobility events. Specifically defining $e_{ijst} = 1$ as an indicator for whether a manager-year observation falls into the event-sample described, we estimate, for firm i, position j, manager s and year t

$$\Delta w_{ijst} = \sum_{e_{ijst} \in \{0,1\}} \sum_{q=2}^{Q} \left(\omega_{t,q,e} \left[\Delta t_{st}^{q} \times e_{ijst} \right] + \omega_{\tau,q,e} \left[\Delta \tau_{ist}^{q} \times e_{ijst} \right] \right) + \gamma_j + \phi_s + \Delta \nu_{jst} \tag{24}$$

The slope coefficients in (24) are most useful for identifying $g(\cdot)$ and $k(\cdot)$. We use variation in the change in wages across the tenure that the CEO made the switch to identify how losses in firm-specific capital impact wages. We also include position × firm and executive fixed effects, which will net out any impact changes in wages arising from differences across positions and executives.

We also include the volatility of the residual and the residual autocorrelation to help further separate the human capital shock from the human capital accumulation functions in these two regressions.

4. Conclusion

This paper presents a model of the executive labor market that incorporates managerial bargaining power, on-the-job search, general and firm-specific capital, and executive heterogeneity. Our primary contribution is to measure the relative importance of general and firm-specific human capital. We also show that firm-specific human capital impacts managerial mobility across their careers: as firm-specific skill accumulates, executives are (relatively) less likely to switch jobs, (relatively) more likely to receive job offers which lead to renegotiations of the contract at the incumbent firm. This occurs because firm-specific capital increases the match-specific quality between the manager and firm over time.

Our work has important implications for the corporate finance literature. Understanding the composition of managerial capital informs the debate in the study of CEOs about the importance of general vs. firm-specific skills, which is a crucial fact for interpreting increases in CEO pay over time (Gabaix and Landier, 2008; Murphy and Zabojnik, 2007).

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A. Model Appendix

A.1. Derivation of Bargaining Rules

Derivation of sharing rule for internal promotions. Suppose an executive is approached by their firm and evaluated for a promotion to CEO. First, a new match productivity parameter p' is drawn, summarizing the executive's fitness for the CEO position. Each party makes alternating offers over the piece rate r'. If the offer is accepted, the bargaining game ends. If the offer is rejected, some time elapses before a counteroffer is made. Let Δ_e and Δ_f respectively denote the lengths of time which elapse following a rejection by the executive and firm. It is also assumed that during negotiations, the match severs at rate η in which case the executive remains in their current position, and additional offers for outside CEO and non-CEO positions respectively arrive at rates λ_1 and λ_2. The subgame perfect equilibrium of this game consists of piece rate offers (r_e, r_f) which make the other party indifferent between immediate acceptance and waiting to make a counteroffer. That is, r_e and r_f respectively solve:

$$
\begin{aligned}
V_C(r_f, h, \tau, p') = \frac{1}{1+\rho\Delta_e}\Big[& w_t\Delta_e + \eta\Delta_e V_E(r, h, \tau, p) + \lambda_1\Delta_e\tilde{V}_C(\cdot) + \lambda_2\Delta_e\tilde{V}_E(\cdot) \\
& + (1-\Delta_e(\eta+\lambda_1+\lambda_2))V_C(r_e, h, \tau, p')\Big] \qquad \text{(A.1)}\\
\Pi_C(r_e, h, \tau, p') = \frac{1}{1+\rho\Delta_f}\Big[& \pi_0\Delta_e + \eta\Delta_e\Pi_0 + \lambda_0\Delta_f\tilde{\Pi}_C(\cdot) + \lambda_1\Delta_f\tilde{\Pi}_C(\cdot) \\
& + (1-\Delta_f(\eta+\lambda_0+\lambda_1))\Pi_C(r_f, h, \tau, p')\Big] \qquad \text{(A.2)}
\end{aligned}
$$

$\Pi_C(x)$ denotes the value to the firm of filling the CEO position given state x. π_0 and Π_0 denote the flow and net present values to the firm of having a vacant CEO position, both of which we assume to equal 0. $\tilde{V}_C$ and $\tilde{V}_E$ denote the executive's net present value of initiating a new bargaining game for a CEO or non-CEO position upon the arrival of a competing offer. Similar for $\tilde{\Pi}_C$. The two equations above can be rewritten as:

$$
V_C(r_f, h, \tau, p') - V_C(r_e, h, \tau, p') = -\Delta_e\Big[(\eta+\lambda_1+\lambda_2)V_C(r_e, h, \tau, p') + \rho V_C(r_f, h, \tau, p')
$$

$$- w_t - \eta V_E(r,h,\tau,p) - \lambda_1 \tilde{V}_C(\cdot) - \lambda_2 \tilde{V}_E(\cdot)\Big] \tag{A.3}$$

$$\Pi_C(r_e,h,\tau,p') - \Pi_C(r_f,h,\tau,p') = -\Delta_f\Big[(\eta+\lambda_0+\lambda_1)\Pi_C(r_f,h,\tau,p') + \rho\Pi_C(r_e,h,\tau,p')$$

$$- \pi_0 - \eta\Pi_0 - \lambda_0\tilde{\Pi}_C(\cdot) - \lambda_1\tilde{\Pi}_E(\cdot)\Big] \tag{A.4}$$

The above conditions imply that $r_f \to r_e$ as $\Delta_f, \Delta_e \to 0$. Denote their common limit by r' and define:

$$\frac{\partial V_C}{\partial r}(r,h,\tau,p') = \lim_{\Delta_f,\Delta_e\to 0} \frac{V_C(r_f,h,\tau,p') - V_C(r_e,h,\tau,p')}{r_f - r_e} \tag{A.5}$$

$$\frac{\partial \Pi_C}{\partial r}(r,h,\tau,p') = \lim_{\Delta_f,\Delta_e\to 0} \frac{V_C(r_f,h,\tau,p') - V_C(r_e,h,\tau,p')}{r_f - r_e} \tag{A.6}$$

Using the definitions above and taking the ratios of (A.3) and (A.4) yields:

$$-\frac{\frac{\partial V_C}{\partial r}(r',h,\tau,p')}{\frac{\partial \Pi_C}{\partial r}(r',h,\tau,p')} = \frac{\Delta_e(\rho+\eta+\lambda_1+\lambda_2)}{\Delta_f(\rho+\eta+\lambda_0+\lambda_1)} \frac{V_C(r',h,\tau,p') - \frac{w_t+\eta V_E(r,h,\tau,p)+\lambda_1\tilde{V}_C(\cdot)+\lambda_2\tilde{V}_E(\cdot)}{\rho+\eta+\lambda_1+\lambda_2}}{\Pi_C(r',h,\tau,p') - \frac{\pi_0+\eta\Pi_0+\lambda_0\tilde{\Pi}_C(\cdot)+\lambda_1\tilde{\Pi}_E(\cdot)}{\rho+\eta+\lambda_0+\lambda_1}} \tag{A.7}$$

Next, define $S(h,\tau,p') = \Pi_C(r',h,\tau,p') + V_C(r',h,\tau,p') - V_E(r,h,\tau,p)$ as the surplus associated with the position. Note that $\Pi_C(0,h,\tau,p') = 0$, which implies that $\Pi_C(r',h,\tau,p') = V_C(0,h,\tau,p') - V_C(r',h,\tau,p')$. Thus, $\frac{\partial \Pi_C}{\partial r}(r',h,\tau,p') = -\frac{\partial V_C}{\partial r}(r',h,\tau,p')$. Applying this to (A.7) and taking the limit as $\eta \to \infty$ yields (after some algebra):

$$V_C(r',h,\tau,p') = \beta_0 V_C(0,h,\tau,p') + (1-\beta_0)V_E(r,h,\tau,p) \tag{A.8}$$

where $\beta_0 = \frac{\Delta_f}{\Delta_f+\Delta_e}$.[1] Note that the sharing rule implies that it is in the executive's interest to accept the promotion to CEO if and only if $V_C(0,h',\tau',p') > V_E(r,h',\tau',p)$. Define $\overline{\theta_0}(r,h,\tau,p)$ as the

[1]Under this game-theoretic interpretation of the bargaining parameter, the executive's bargaining power increases in the time Δ_f it takes the firm to come up with a counteroffer. This is fairly unimportant and in no way changes the empirical treatment of the parameter β_0. Also, the form of the sharing rules hinges on the assumption that the separation rate η is large relative to the arrival rates of competing offers. This is a technical assumption that for our purposes will be buried in the appendix.

critical level of match productivity such that:

$$V_C(0, h, \tau, \overline{\theta_0}) = V_E(r, h, \tau, p) \tag{A.9}$$

If $p' > \overline{\theta_0}$, the executive accepts the CEO role under the wage contract defining (A.8). If $p' \leq \overline{\theta_0}$, the executive can never be swayed into accepting the CEO role and instead remains in their current position.

Derivation of sharing rule for horizontal moves (Executive). Consider an executive who is approached by an outside firm to serve in an executive position. Upon the arrival of the offer, the executive along with the competing and incumbent firms initiate a bargaining game with the following structure:

1. Stage 1: Both firms simultaneously offer a piece rate to the executive
2. Stage 2: The executive chooses one of the offers, or rejects and keeps their current position.
3. Stage 3: If the executive accepted an offer in Stage 2, some time elapses. The executive then renegotiates with the firm whose offer was rejected, where the renegotiation protocol mirrors that of the previous section. Unlike the previous section, however, the executive's outside is option is not their current position, but the offer accepted in Stage 2.

The bargaining game is solved via backward induction. Let r_1' and r_1 denote the Stage 1 offers from firms p' and p. Suppose that r_1 was accepted in the second stage, triggering a Stage 3 renegotiation with firm p'. The offer from p' will satisfy:

$$V_E(r, h, 0, p') = \beta_1 V_E(0, h, 0, p') + (1 - \beta_1) V_E(r_1, h, \tau, p) \tag{A.10}$$

Conversely, suppose that r_1' was accepted in Stage 2. In the subsequent renegotiation with firm p, their counteroffer will satisfy:

$$V_E(r, h, \tau, p) = \beta_1 V_E(0, h, \tau, p) + (1 - \beta_1) V_E(r_1', h, 0, p') \tag{A.11}$$

The form of the counteroffers implies that:

- If r_1' was accepted in Stage 2, renegotiate and eventually work with p iff:

$$V_E(0, h, \tau, p) \geq V_E(r_1', h, 0, p') \tag{A.12}$$

- If r_1 was accepted in Stage 2, renegotiate and eventually work with p' iff:

$$V_E(0, h, 0, p') > V_E(r_1, h, \tau, p) \tag{A.13}$$

Thus, the value of accepting r_1 at Stage 2 is:

$$V = \max\{\beta_1 V_E(0, h, 0, p') + (1 - \beta_1) V_E(r_1, h, \tau, p), V_E(r_1, h, \tau, p)\} \tag{A.14}$$

Similarly for r_1':

$$V = \max\{\beta_1 V_E(0, h, \tau, p) + (1 - \beta_1) V_E(r_1', h, 0, p'), V_E(r_1', h, 0, p')\} \tag{A.15}$$

Moving back to Stage 1, both firms make simultaneous offers. For firm p' to eventually win the executive, they must bid r_1' such that $V_E(r_1', h, 0, p') > V_E(0, h, \tau, p)$ so that firm p cannot afford to outbid p'. Acknowledging the transferability of p and k, firm p' eventually wins the worker if and only if $p' > p + k'$. In this case, to avoid wasting time in the renegotiation stage, firm p' immediately offers r_1' such that:

$$V_E(r_1', h, 0, p') = \beta_1 V_E(0, h, 0, p') + (1 - \beta_1) V_E(0, h, \tau, p) \tag{A.16}$$

Conversely, if $p' < p + k'$, firm p will eventually win the executive's services. The fastest way of doing so is to immediately offer r_1 such that:

$$V_E(r_1, h, \tau, p) = \beta_1 V_E(0, h, \tau, p) + (1 - \beta_1) V_E(0, h, 0, p') \tag{A.17}$$

Note additionally that a competing offer does not necessitate an alteration of the current piece rate r. The minimal value of p' such that something happens is defined by:

$$V_E(r, h, \tau, p) = \beta_1 V_E(0, h, \tau, p) + (1 - \beta_1) V_E(0, h, 0, \underline{\theta}_E) \tag{A.18}$$

Derivation of sharing rule for external promotions. Consider an executive who is approached by an outside firm to become CEO. A three-player bargaining game is initiated with the same structure as in the previous case. Note, however, that unlike the previous case, the executive is weighing two separate types of positions: a CEO position and a non-CEO position. Because the two position types are associated with different event spaces describing the possible set of future offers, the executive's value of accepting these positions, for a given state, is not equal in general.

As before, the bargaining game is solved via backward induction. Let $(r_1', 1)$ and $(r_1, 0)$ denote the stage 1 offers from firms p' and p, where the second coordinate indicates if the offer is for a CEO position or not. Suppose the executive accepted $(r_1, 0)$ at Stage 2, then renegotiates with p' in Stage 3. The offer from p' will satisfy:

$$V_C(r, h, 0, p') = \beta_1 V_C(0, h, 0, p') + (1 - \beta_1) V_E(r_1, h, \tau, p) \tag{A.19}$$

Conversely, suppose that $(r_1', 1)$ was accepted at stage 2, and a stage 3 renegotiation was triggered with firm p. Firm p's counteroffer will satisfy:

$$V_E(r, h, \tau, p) = \beta_1 V_E(0, h, \tau, p) + (1 - \beta_1) V_C(r_1', h, 0, p') \tag{A.20}$$

Implications:

- If $(r_1', 1)$ is accepted at stage 2, renegotiate and eventually work with p iff:

$$V_E(0, h, \tau, p) \geq V_C(r_1', h, 0, p') \tag{A.21}$$

- If $(r_1, 0)$ is accepted at stage 2, renegotiate and eventually work with p' iff:

$$V_C(0, h, 0, p') > V_E(r_1, h, \tau, p) \tag{A.22}$$

Thus, the value of accepting $(r_1, 0)$ at stage 2 is:

$$V = \max\{\beta_1 V_C(0, h, 0, p') + (1 - \beta_1)V_E(r_1, h, \tau, p), V_E(r_1, h, \tau, p)\} \tag{A.23}$$

Similarly for $(r_1', 1)$:

$$V = \max\{\beta_1 V_E(0, h, \tau, p) + (1 - \beta_1)V_E(r_1, h, 0, p), V_C(r_1', h, 0, p')\} \tag{A.24}$$

At stage 1, simultaneous offers are made. For firm p' to win the executive, they must bid r_1' such that: $V_C(r_1', h, 0, p') > V_E(0, h, \tau, p) = V_C(0, h, \tau, \overline{\theta_0})$. Again acknowledging the transferability of k and p, the previous inequality is equivalent to $V_C(r_1', h', 0, p') > V_C(0, h', 0, \overline{\theta_0} + k')$. Hence, firm p' eventually wins the worker if and only if $p' > \overline{\theta_0} + k'$. In this case, to avoid wasting time in the renegotiation stage, firm p' immediately offers r_1' such that:

$$V_C(r_1', h, 0, p') = \beta_1 V_C(0, h, 0, p') + (1 - \beta_1)V_E(0, h, \tau, p) \tag{A.25}$$

Conversely, suppose that $p' < \overline{\theta_0} + k'$. Similar to the above case, firm p will retain the worker in the fastest manner possible by immediately offering r_1 such that:

$$V_E(r_1, h, \tau, p) = \beta_1 V_E(0, h, \tau, p) + (1 - \beta_1)V_C(0, h, 0, p') \tag{A.26}$$

As in the case of horizontal moves, an outside offer for a CEO appointment need not trigger a change in the current piece rate r. The minimum value of p' such that something happens is defined by:

$$V_E(r,h,\tau,p) = \beta_1 V_E(0,h,\tau,p) + (1-\beta_1)V_C(0,h,0,\underline{\theta}_O) \tag{A.27}$$

Derivation of sharing rule for horizontal moves (CEO). This case is identical to the case for horizontal executive moves if we simply change subscripts. Upon receiving an offer for a CEO position with match productivity $p' > p+k$, the CEO switches positions and receives initial piece rate r' defined by condition:

$$V_E(r',h,\tau,p) = \beta_1 V_E(0,h,\tau,p) + (1-\beta_1)V_C(0,h,0,p') \tag{A.28}$$

As in the previous cases, if instead $p' > p+k$, the current firm retains the CEO and a renegotiation may be triggered. The minimum value of p' such that the piece rate is revised is defined by:

$$V_C(r,h,\tau,p) = \beta_1 V_C(0,h,\tau,p) + (1-\beta_1)V_C(0,h,0,\underline{\theta_C}) \tag{A.29}$$

A.2. CEO Value Function Derivation

To obtain closed-form expressions for CEO piece rates, we first derive a simplified version of the value function (12). Rearranging terms via integration by parts yields:

$$\begin{aligned}(\rho+\mu+\eta)V_C(r,k,p) = r+g+k+p+\eta V_U(h) + \lambda_1\beta_1 \int_{p+k}^{p_{max}} \frac{\partial V_C}{\partial x}(0,0,x)S(x)dx \\ + \lambda_1(1-\beta_1)\int_{\underline{\theta}_C}^{p+k} \frac{\partial V_C}{\partial x}(0,0,x)S(x)dx\end{aligned} \tag{A.30}$$

Setting $r=0$ and differentiating with respect to p (applying Leibniz' rule) yields:

$$\frac{\partial V_C}{\partial p}(0,k,p) = \frac{1}{\rho+\mu+\eta+\lambda_1\beta_1 S(p)} \equiv \phi_C(p) \tag{A.31}$$

The value function (12) can then be expressed as:

$$(\rho + \mu + \eta)V_C(r, k, p) = r + g + k + p + \eta V_U(h) + \lambda_1\beta_1 \int_{p+k}^{p_{max}} \phi_C(x)S(x)dx$$
$$+ \lambda_1(1 - \beta_1) \int_{\underline{\theta}_C}^{p+k} \phi_C(x)S(x)dx \tag{A.32}$$

A.3. Executive Value Function Derivation

Similar to the case of CEOs, we simplify the executive value function by first rearranging (13) via integration by parts:

$$(\rho + \mu + \eta)V_E(r, k, p) = r + g + k + p + \eta V_U(h) + \lambda_0\beta_0 \int_{\bar{\theta}}^{p_{max}} \frac{\partial V_C}{\partial x}(0, k, x)S(x)dx$$
$$+ \lambda_1\beta_1 \int_{\bar{\theta}+k}^{p_{max}} \frac{\partial V_C}{\partial x}(0, 0, x)S(x)dx + \lambda_1(1 - \beta_1) \int_{\underline{\theta}_O}^{\bar{\theta}+k} \frac{\partial V_C}{\partial x}(0, 0, x)S(x)dx$$
$$+ \lambda_2\beta_1 \int_{p+k}^{p_{max}} \frac{\partial V_E}{\partial x}(0, 0, x)S(x)dx + \lambda_2(1 - \beta_1) \int_{\underline{\theta}_E}^{p+k} \frac{\partial V_E}{\partial x}(0, 0, x)S(x)dx \tag{A.33}$$

Again setting $r = 0$ and differentiating with respect to p yields:

$$\frac{\partial V_E}{\partial p}(0, k, p) = \frac{1 - \phi_C(\bar{\theta} + k)\frac{\partial\bar{\theta}}{\partial p}\left(\lambda_0\beta_0 S(\bar{\theta}) + \lambda_1\beta_1 S(\bar{\theta} + k)\right)}{\rho + \mu + \eta + \lambda_2\beta_1 S(p + k)} \tag{A.34}$$

Differentiating Equation (5) evaluated at $r = 0$ yields:

$$\frac{\partial\bar{\theta}}{\partial p}(0, k, p) = \frac{\frac{\partial V_E}{\partial p}(0, k, p)}{\phi_C(\bar{\theta} + k)} \tag{A.35}$$

Substituting the expression above into Equation (A.34) and simplifying then yields:

$$\frac{\partial V_E}{\partial p}(0, k, p) = \frac{1}{\rho + \mu + \eta + \lambda_2\beta_1 S(p + k) + \lambda_1\beta_1 S(\bar{\theta} + k) + \lambda_0\beta_0 S(\bar{\theta})} \equiv \phi_E(p, k) \tag{A.36}$$

The executive value function can then be expressed as:

$$
\begin{aligned}
(\rho+\mu+\eta)V_E(r,k,p) = r + g + k + p + \eta V_U(h) + \lambda_0\beta_0 \int_{\bar{\theta}}^{p_{max}} \phi_C(x+k)S(x)dx \\
+ \lambda_1\beta_1 \int_{\bar{\theta}+k}^{p_{max}} \phi_C(x)S(x)dx + \lambda_1(1-\beta_1)\int_{\underline{\theta}_O}^{\bar{\theta}+k} \phi_C(x)S(x)dx \\
+ \lambda_2\beta_1 \int_{p+k}^{p_{max}} \phi_E(x,0)S(x)dx + \lambda_2(1-\beta_1)\int_{\underline{\theta}_E}^{p+k} \phi_E(x,0)S(x)dx
\end{aligned}
\tag{A.37}
$$

With both the executive and CEO value functions in hand, we can present the formal proof of Theorem 1.

Proof of Theorem 1. Observe that for all values of p:

$$
\frac{\partial\bar{\theta}}{\partial p}(0,k,p) = \frac{\phi_E(p,k)}{\phi_E(\bar{\theta}+k)} = \frac{\rho+\mu+\eta+\lambda_1\beta_1\bar{F}(\bar{\theta}+k)}{\rho+\mu+\eta+\lambda_2\beta_1\bar{F}(p+k)+\lambda_1\beta_1\bar{F}(\bar{\theta}+k)+\lambda_0\beta_0\bar{F}(\bar{\theta})} \leq 1 \tag{A.38}
$$

Then:

$$
\begin{aligned}
p - \bar{\theta}(0,k,p) &= \int_{p_{min}}^{p} dx - \int_{p_{min}}^{p} \frac{\partial\bar{\theta}}{\partial x}(0,k,x)dx \\
&= \int_{p_{min}}^{p} \left(1 - \frac{\partial\bar{\theta}}{\partial x}(0,k,x)\right)dx \geq 0
\end{aligned}
\tag{A.39}
$$

since the integrand is positive for all values in the support of p. ■

A.4. CEO Piece Rate Derivation

Horizontal Hires. The bargaining condition (A.28) implies:

$$
\begin{aligned}
r = \beta_1\left(p' + \lambda_1\beta_1\int_{p'}^{p_{max}} \phi_C(x)S(x)dx\right) + (1-\beta_1)\left(p + k_- + \lambda_1\beta_1 \int_{p+k_-}^{p_{max}} \phi_C(x)S(x)dx\right) \\
- p' - \lambda_1\beta_1\int_{p'}^{p_{max}} \phi_C(x)S(x)dx - \lambda_1(1-\beta_1)\int_{p+k_-}^{p'} \phi_C(x)S(x)dx
\end{aligned}
\tag{A.40}
$$

Combining terms yields:

$$
\begin{aligned}
r &= -(1-\beta_1)\big(p' - p - k_-\big) - \lambda_1(1-\beta_1)^2 \int_{p+k_-}^{p'} \phi_C(x)S(x)dx \\
&= -(1-\beta_1)\int_{p+k_-}^{p'} \frac{\rho+\mu+\eta+\lambda_1 S(x)}{\rho+\mu+\eta+\lambda_1\beta_1 S(x)}dx \\
&= \int_{p+k_-}^{p'} q(x)dx \equiv r_C^{hor}(p', 0, p+k_-) \qquad \text{(A.41)}
\end{aligned}
$$

Diagonal Hires. Applying the definition of $\bar{\theta}$ (Equation (5)), the bargaining condition (A.26) can be rewritten as:

$$
V_C(r, 0, p) = \beta_1 V_C(0, 0, p') + (1-\beta_1)V_C(0, k, \bar{\theta}(0, k, p)) \qquad \text{(A.42)}
$$

Inserting the associated value functions then yields:

$$
\begin{aligned}
r = \beta_1\left(p' + \lambda_1\beta_1 \int_{p'}^{p_{max}} \phi_C(x)S(x)dx\right) + (1-\beta_1)\left(\bar{\theta}(p, k_-) + k_- + \lambda_1\beta_1 \int_{p+k_-}^{p_{max}} \phi_C(x)S(x)dx\right) \\
- p' - \lambda_1\beta_1 \int_{p'}^{p_{max}} \phi_C(x)S(x)dx - \lambda_1(1-\beta_1)\int_{\bar{\theta}(0,k_-,p)+k_-}^{p'} \phi_C(x)S(x)dx \qquad \text{(A.43)}
\end{aligned}
$$

Collecting terms and rearranging yields:

$$
\begin{aligned}
r &= -(1-\beta_1)\big(p' - \bar{\theta}(p, k_-) - k_-\big) - \lambda_1(1-\beta_1)^2 \int_{\bar{\theta}(0,k_-,p)+k_-}^{p'} \phi_C(x)S(x)dx \qquad \text{(A.44)} \\
&= -(1-\beta_1)\int_{\bar{\theta}(0,k_-,p)+k_-}^{p'} \frac{\rho+\mu+\eta+\lambda_1 S(x)}{\rho+\mu+\eta+\lambda_1\beta_1 S(x)}dx \qquad \text{(A.45)} \\
&= -(1-\beta_1)\int_{\bar{\theta}(0,k_-,p)+k_-}^{p'} q(x)dx \qquad \text{(A.46)} \\
&= r_C^{hor}(p', 0, p+k_-) - (1-\beta_1)\int_{\bar{\theta}(0,k_-,p)+k_-}^{p+k_-} q(x)dx \equiv r_C^{diag}(p', 0, p+k_-) \qquad \text{(A.47)}
\end{aligned}
$$

Vertical Hires. Similar to the previous case, we can apply the definition of $\bar{\theta}$ and rewrite the bargaining condition (A.8) as:

$$V_C(r,k,p') = \beta_0 V_C(0,k,p') + (1-\beta_0) V_C(0,k,\bar{\theta}(r,k,p)) \tag{A.48}$$

Inserting the definition of the value function yields:

$$\begin{aligned} r = {} & \beta_0 \left(p' + k + \lambda_1\beta_1 \int_{p'}^{p_{max}} \phi_C(x)S(x)dx \right) + (1-\beta_0)\left(\bar{\theta}(r,k,p) + k + \lambda_1\beta_1 \int_{p+k_-}^{p_{max}} \phi_C(x)S(x)dx \right) \\ & - p' - k - \lambda_1\beta_1 \int_{p'}^{p_{max}} \phi_C(x)S(x)dx - \lambda_1(1-\beta_1) \int_{\bar{\theta}(r,k,p)+k}^{p'} \phi_C(x)S(x)dx \end{aligned} \tag{A.49}$$

Substituting the identity $\beta_0 = \beta_0 + \beta_1 - \beta_1$ and collecting terms yields:

$$\begin{aligned} r = {} & \overbrace{-(1-\beta_1) \int_{\bar{\theta}(r,k,p)+k}^{p'} q(x)dx}^{r_C^{diag}(p',0,p+k)} -(1-\beta_1) \int_{p'}^{p'+k} q(x)dx \\ & + (\beta_0 - \beta_1) \int_{\bar{\theta}(r,k,p)+k}^{p'} \frac{\rho+\mu+\eta}{\rho+\mu+\eta+\lambda_1\beta_1\bar{F}(x)} dx \equiv r_C^{vert}(p',0,p+k) \end{aligned} \tag{A.50}$$

A.5. Executive Piece Rate Derivation

The bargaining condition for horizontal executive moves (Equation (A.16)) implies:

$$\begin{aligned} r = {} & \beta_1 \left(p' + \lambda_0\beta_0 \int_{\bar{\theta}(p',0)}^{p_{max}} \phi_C(x)S(x)dx + \lambda_1\beta_1 \int_{\bar{\theta}(p,k_-)}^{p_{max}} \phi_C(x)S(x)dx + \lambda_2\beta_1 \int_{p'}^{p_{max}} \phi_E(x)S(x)dx \right) \\ & + (1-\beta_1)\left(p + k_- + \lambda_0\beta_0 \int_{\bar{\theta}(p,k_-)}^{p_{max}} \phi_C(x)S(x)dx + \lambda_1\beta_1 \int_{\bar{\theta}(p,k_-)+k_-}^{p_{max}} \phi_C(x)S(x)dx + \lambda_2\beta_1 \int_{p+k_-}^{p_{max}} \phi_E(x)S(x)dx \right) \\ & - p' - \lambda_0\beta_0 \int_{\bar{\theta}(p',0)}^{p_{max}} \phi_C(x)S(x)dx - \lambda_1\beta_1 \int_{\bar{\theta}(p,k_-)}^{p_{max}} \phi_C(x)S(x)dx - \lambda_2\beta_1 \int_{p'}^{p_{max}} \phi_E(x)S(x)dx \\ & - \lambda_1(1-\beta_1) \int_{\bar{\theta}(p,k_-)+k_-}^{\bar{\theta}(p',0)} \phi_C(x)S(x)dx - \lambda_2(1-\beta_1) \int_{p+k_-}^{p'} \phi_E(x)S(x)dx \end{aligned} \tag{A.51}$$

Simplifying and collecting terms yields:

$$\begin{aligned} r = &-(1-\beta_1)\big(p' - p - k_-\big) - \lambda_2(1-\beta_1)^2 \int_{p+k_-}^{p'} \phi_E(x)S(x)dx \\ &- \lambda_1(1-\beta_1)^2 \int_{\bar{\theta}(p,k_-)+k_-}^{\bar{\theta}(p',0)} \phi_C(x)S(x)dx + \lambda_0\beta_0(1-\beta_1) \int_{\bar{\theta}(p,k_-)}^{\bar{\theta}(p',0)} \phi_C(x)S(x)dx \end{aligned} \tag{A.52}$$

which is equivalent to Equation (20).

A.6. Characterization of the CEO Renegotiation Set

We restrict the analysis of this section to the special case of the model in which $\beta_0 = \beta_1$; more general results are a work in progress. The renegotiation set is defined as the closed interval $[\theta_C(p,k), p+k]$ with mass $\Omega_r^m(p,k)$ for $m \in \{hor, diag, vert\}$. $\theta_C(p,k)$ is defined implicitly by the following equation:

$$r = -\int_{\theta_C(p,k)}^{p+k} q(x)dx \tag{A.53}$$

where the left hand side denotes the CEO's current piece rate and the right hand side is the revised piece rate in case of a renegotiation. The form of the piece rate r, of course, depends on the path up the job ladder the manager took before landing in the CEO position. We begin with the case of horizontally-hired CEOs. Letting $p_- + k_-$ denote the sum of the match productivity and firm-specific human capital associated with the CEO's previous position at time of departure, inserting the definition of r_C^{hor} (Equation (14)), and rearranging terms yields:

$$\int_z^p q(x)dx = \int_{\theta_C(p,k)}^{p+k} q(x)dx \tag{A.54}$$

$$\int_p^{p+k} q(x)dx = \int_{p_-+k_-}^{\theta_C(p,k)} q(x)dx \tag{A.55}$$

Equation (A.55) implies that at time of hire (i.e. when $k = 0$), $\theta_C(p,0) = p_- + k_-$. The dynamics of $\theta_C(p,k)$ as k increases can be obtained by implicitly differentiating (A.55) with respect to k:

$$\frac{\partial \theta_C}{\partial k}(p,k) = \frac{q(p+k)}{q(\theta_C(p,k))} < 1 \tag{A.56}$$

where the inequality follows from the fact that $q(x)$ is monotonically decreasing. Additionally, the differential equation (A.56) is independent of $p_- + k_-$. Thus, while the initial value of θ_C upon taking a new CEO position will differ by CEO type, the slope of θ_C with respect to k is independent of CEO type. Using the same approach as above, the initial condition of θ_C for diagonally-hired CEOs is apparent by inspecting the equation:

$$\int_p^{p+k} q(x)dx = \int_{\bar{\theta}(p_-,k_-)+k_-}^{\theta_C(p,k)} q(x)dx \tag{A.57}$$

Hence, for diagonally-hired CEOs $\theta_C(p,0) = \bar{\theta}(p_-,k_-)+k_-$. Characterizing θ_C for vertically-hired CEOs is made difficult by the fact that $\beta_0 \neq \beta_1$ in general. We thus restrict attention to the special case where $\beta_0 = \beta_1$ for now. Consider then a vertically-hired CEO with τ units of firm-specific tenure at time of hire. We can write:

$$\int_{\bar{\theta}(p_-,k)+k}^{p+k(\tau)} q(x)dx = \int_{\theta_C(p,k)}^{p+k(\tau+\Delta)} q(x)dx \tag{A.58}$$

$$\int_{p+k(\tau)}^{p+k(\tau+\Delta)} q(x)dx = \int_{\bar{\theta}(p_-,k)+k}^{\theta_C(p,k)} q(x)dx \tag{A.59}$$

At the point of promotion (when $\Delta = 0$), $\theta_C(p,k(\tau)) = \bar{\theta}(p_-,k) + k$. Because θ_C monotonically increases with k, this implies that the value of $\theta_C(p,0)$ is smaller for vertically-hired CEOs relative to diagonally-hired CEOs. With these results in hand, we can state formally the proof of Theorem 2:

Proof of Theorem 2. Define $\Omega_r^m(p,k) = p + k - \theta_C(p,k)$. Differentiating with respect to p:

$$\frac{\partial \Omega_r^m}{\partial k}(p,k) = 1 - \frac{\partial \theta_C}{\partial k}(p,k) > 0 \tag{A.60}$$

which follows from the fact that $\frac{\partial \theta_C}{\partial k}(p,k) < 1$. Let $z^m = \theta_C(p,0)$ for $m \in \{hor, diag, vert\}$ denote the type-specific initial condition of $\theta_C(p,k)$. As $z^{vert} < z^{diag} < z^{hor}$, it follows that for any (p,k):

$$\Omega_r^{vert}(p,k) > \Omega_r^{diag}(p,k) > \Omega_r^{hor}(p,k) \tag{A.61}$$

$\blacksquare$

B. Estimation Appendix

B.1. Weighting Matrix

From the empirical sample we obtain a $K \times 1$ vector of moments $\hat{M}$. Let Ψ denote the corresponding $N \times K$ matrix of influence functions, N being the number of observations in the sample. Each element Ψ_{nk} is the influence function describing observation n's contribution to moment k. The covariance matrix of the vector of moments can then be estimated as:

$$a\hat{var}(\hat{M}) = \Psi'\Psi \tag{B.1}$$

The weighting matrix $\hat{W}$ is then obtained as the inverse of matrix B.1. Let $\Theta \in \mathbb{R}^P$ denote an arbitrary vector of structural parameters. Define the moment residual $g : \mathbb{R}^P \to \mathbb{R}^M$ as:

$$g(\Theta) = \hat{M} - \frac{1}{S}\sum_{s=1}^{S} \hat{m}^s(\Theta) \tag{B.2}$$

Where $\hat{M}$ is the vector of empirical moments, $\hat{m}^s(\Theta)$ is the vector of simulated moments given parameter values Θ in simulation s, and S is the total number of simulations. The vector of estimates $\hat{\Theta}$ minimizes the SMM objective function:

$$\hat{\Theta} = \arg\min_{\Theta} \; g(\Theta)\hat{W}g(\Theta)' \tag{B.3}$$

B.2. Model Estimation Algorithm

We minimize the SMM quadratic form using the particle swarm algorithm. The routine proceeds as follows:

1. *Set initial guesses for model parameters:* We set initial values for the structural parameters Θ. The initial guess is chosen manually, while subsequent guesses are selected by the particle

swarm algorithm.

2. *Simulate model:*

3. *Construct simulated panel and compute moments:* Using the simulated data, we construct a panel resembling the empirical sample and compute the same moments as described in Section 3.

4. *Evaluate objective function:* Given the set of simulated moments, we evaluate the SMM objective function (). If the objective function value satisfies the particle swarm stopping criterion, the algorithm halts. Otherwise, a new candidate parameter vector Θ' is selected and steps 2-5 repeat. This continues until the algorithm halts.