BUILD VS BUY DYNAMICS: COMPUTATIONALLY MODELING THE EFFECTS OF INTERNAL AND EXTERNAL HIRING PREFERENCES ACROSS TIME, JOB LEVEL, AND STRUCTURE

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ABSTRACT

Extant staffing literature suggests that internally promoted candidates tend to yield greater performance outcomes than external hires. However, these findings are generally based on research designs that do not consider multilevel and temporal effects. The current study advances literature in this area by integrating prior research to develop a computational model that examines the impact of hiring externally vs. promoting internally on organizational competencies over time, across organizational levels and structures, and at different levels of organizational investment into employee skill acquisition. Results from virtual experiments suggest a cross-over interaction such that internal hires yield initial greater competency levels, but external hires yield greater competency levels in the long-run. Additionally, these results seem to hold at both the individual contributor and managerial levels. However, these results are contingent on the amount of headcount concentrated at a given level. Specifically, the long-term benefits of hiring externally are most apparent at levels of the organization where headcount is highly concentrated. Interestingly, investment in skill acquisition seems to exacerbate the benefits of hiring external hires over time. Together, these results have implications for staffing practices across different job levels and organizational structures.

This dissertation is dedicated to Sanjana. For all the words we have yet to share.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

A primary way that organizations secure competitive advantages and increase firm performance is through talent acquisition and retention (Ployhart & Hale, 2014; Barney, 1991). However, talent acquisition and retention has become more challenging in recent years as the labor market has become characterized by more rapid job movement and turnover stemming from increased employee empowerment and changes to organizational design (e.g., virtual work; Bidwell, 2013; Bidwell & Keller, 2014). When turnover occurs, open job positions are backfilled in one of two ways: (1) organizations can promote lower-level employees to the open position or (2) organizations can acquire talent through external hires who hold roles similar to the open position (Bidwell & Mollick, 2015). Prior research has compared the impact of internal vs. external hiring preferences on key outcomes, such as the skill levels of new hires (e.g., Bidwell, 2011). In general, results of prior work suggest that although external hires might have greater experience in similar roles (Chan, 2006; DeVaro et al., 2019; Bidwell & Mollick, 2014), internal hires tend to show greater initial performance than external hires (DeOrtentiis et al., 2018; Abdulsallam, 2019; Bidwell, 2011). These findings have led to some consensus that internal hires provide a performance advantage for organizations.

However, prior research comparing internal to external hires has largely focused on examining the *initial* performance of new hires and assumed that rank differences in performances and employee skillsets will remain stable over time (see DeOrtentiis et al., 2018 for an exception). Moreover, the extant literature appears to assume that the effects of hiring preferences will generalize across all organizational levels (e.g., front-line employees, senior-level leaders, etc.) given that empirical studies have either focused on a single level (e.g., managers; Abdulsallam, 2019) or have not clarified the organizational level under investigation

(e.g., Bidwell, 2011). In contrast to these assumptions, the broader organizational literature consistently depicts organizations as dynamic multilevel systems comprised of employees whose skills can grow and develop over time (Simon, 1991; Kozlowski et al., 2018; Miller et al., 2013; Wolfson et al., 2018). Further, multilevel research and theory (Kozlowski & Klein, 2000) emphasizes there can be meaningful differences across organizational levels and structures with respect to employee skills (Hollenbeck et al., 2012) and potential hiring outcomes (Ployhart, 2004).

The lack of research considering the impact of hiring preferences over time and across organizational levels/structures is concerning given that these characteristics could significantly impact the relationships between staffing practices and organizational outcomes. For example, in an early critique, Ployhart (2004) faulted the existing staffing literature for ignoring that staffing practices could have differential effects across levels stating that "…single level approaches provide an incomplete picture of organizational staffing, and our ability to generalize findings beyond a single level are limited" (p. 139). In a later study, Ployhart et al. (2009) highlighted the importance of temporality, by showing that the flow of employees over time contributed to overall unit effectiveness, and that the relationship was heterogenous among business units. Similar studies have demonstrated the importance of organizational structure (Wellman et al., 2020) and temporality (Grand et al., 2016; Matusik et al., 2020) on other group-based outcomes (e.g., performance, decision-making, cohesion), suggesting that staffing research could benefit from similarly dynamic and multilevel approaches (Eckardt & Jiang, 2019).

The purpose of this dissertation is to advance conceptual clarity around the effects of hiring internally versus externally across time, organizational levels, and structures. Notably, the complexity of the organizational processes underlying dynamic workforce composition (e.g.,

changes in personnel, employee skill growth, etc.) pose key challenges to traditional data collection efforts. The need to account for changes in these competencies across organizational levels and the high-stakes nature of staffing decisions make it impractical to manipulate these processes in a real-world setting and track their effects over long durations across organizational levels. The difficulty in acquiring such data is partly responsible for the lack of research in the extant literature. To overcome these data collection constrains, my dissertation leverages a computational modeling approach to evaluate the effectiveness of different hiring preferences. Computational modeling enables researchers to integrate the process components necessary to approximate a dynamic workforce (i.e., maintain external validity) and virtually manipulate these processes without contamination (i.e., maximize internal validity; Hulin & Ilgen, 2000). Specifically, my dissertation develops a multilevel agent-based model (e.g., Railsback & Grimm, 2019) that tracks the impact of buy-or-build decisions on competency composition over time across organizational levels.

In summary, the goals of this dissertation are threefold. First, I aim to identify whether the benefits of preferring internal hires persist over time. Second, I investigate whether the effectiveness of a hiring preferences depend on organizational level and structure. Third, I examine whether investment in internal development programs can accentuate the benefits of hiring internally. In the following chapters, I begin by reviewing the literature on internal and external hiring and identify three research questions concerning hiring decisions based on prior findings (Chapter 2). To address my research questions, I highlight the need for a dynamic multilevel model and discuss how computational modeling can help test the effectiveness of staffing decisions over time (Chapter 3). To build this model, I integrate existing research to articulate a set of assumptions (see Chapter 4) that approximate an organization and guide the

model's behavior (Kozlowski & Chao, 2018; Kozlowski et al., 2016; Epstein, 1999). Toward these ends, Chapter 4 reviews the literature on competencies, delineates how the importance of certain types of competencies can differ based on job level, and discusses how organizations can lose competencies based on employee turnover due to the employee's intention to quit and their movement capital (Chapter 4). In Chapters 5 and 6 I describe the results of a series of simulations using the computational model that manipulated hiring preferences and employee skill development in order to identify optimal hiring strategies (Chapters 5-6). Based on the results of these simulations, I conclude with a discussion of the theoretical and practical implications (Chapter 7).

CHAPTER 2: LITERATURE REVIEW RESEARCH QUESTION DEVELOPMENT

The exponential growth in the volume and diversity of created jobs, combined with increasing ease of job mobility, have resulted in a highly dynamic workforce with individuals entering and leaving their roles with high frequency (Bonet et al., 2013; Wolfson et al., 2021). When employees leave, their newly open job positions present organizations with a difficult dilemma: organizations can internally hire lower-level employees into the open higher-level position (i.e., promote or "build" human capital) or they can acquire talent externally by hiring new employees who have held roles that are similar to the open position (i.e., "buy" human capital) (Bidwell & Mollick, 2015). Building and buying approaches both have benefits and limitations. When organizations focus on *buying* human capital, they can gain employees with higher levels of transferrable knowledge (Chan, 2006); however, buying human capital can also reduce incentives for existing employees to remain in the organization, thereby increasing turnover and reducing the availability of firm-specific knowledge (e.g., tacit knowledge of organizational culture, routines, processes, and systems; Bidwell, 2011; Bidwell & Keller, 2014; Lei & Hitt, 1995). Alternatively, organizations can retain firm-specific knowledge when they focus on *building* human capital; however, promoting an employee internally can open another role to be filled, cause discontent among other internal applicants who were rejected for the role, and/or may lead the company to miss out on external perspectives (DeOrtentiis et al., 2018). Therefore, understanding when organizations should hire internally and externally is often a fundamental challenge for companies seeking to maintain a competitive talent advantage.

Despite the importance of hiring decisions, relatively few studies have compared the effects of hiring externally compared to internally. In general, research in this domain has focused on the types of companies that prefer internal vs. external hires (e.g., Bidwell & Keller,

2014; DeVaro et al., 2019), the determinants of promotion (e.g., DeNisi et al., 2021; Kalleberg & Reskin, 1995), or the best practices for selecting external hires (e.g., Ployhart et al., 2017). Indeed, DeOrtentiis et al. (2018) commented that "given that virtually all organizations face decisions regarding internal and external selection (Schawbal, 2012; Silverman, 2012), it is surprising that very little empirical research has addressed this issue. We are aware of only a couple of studies that have compared internal and external hires on key outcomes…" (p. 917). The purpose of the current section is to review these studies in order to articulate the extant state of the literature on internal/external hires and identify current assumptions underpinning this research area.

In an early study, Chan (1996) developed a mathematical model of internal and external hire comparisons drawing from the tournaments' literature in labor economics and political economy (Lazear & Rosen 1981; Rosen, 1986). In this model, Chan incorporated worker ability, productivity, and wage differentials to identify the conditions under which a competitive handicap was created for internal candidates. Specifically, when wage differentials were constrained to reduce the likelihood that candidates sabotaged each other (i.e., maintain fair competition), Chan (1996) derived the conditions under which internal candidate effort would be maintained. To ensure effort was maintained or marginally increased when there was a large pool of external candidates that had a realistic chance of winning, employers would need to introduce a positive handicap for internal candidates. Similarly, when external candidates did not have a realistic chance of winning, Chan suggested that employers would lower the probability of promotion for internal candidates to maintain effort among internal candidates. Later, in an empirical sample, Chan (2006) analyzed employee data from 1986 to 1994 at U.S. financial institutions and found that external hires at a given level were more likely to get promoted

compared to internal hires that had been recently promoted to the same level. Taken together, the studies attempted to demonstrate that external candidates had to overcome odds in favor of internal candidates, resulting in higher quality external hires relative to internal hires.

Importantly, Chan's (1996, 2006) studies did not utilize performance data to establish that external hires were more competent than internal hires. Providing the opposite perspective, Bidwell (2011) posited that external hires should actually have lower initial performance compared to internal hires, because they lack the same level of firm-specific skills. Using data from another financial organization from 2003 to 2009, Bidwell directly compared the performance ratings for internal and external hires at a given level. In this study, Bidwell found that internally promoted workers demonstrated significantly higher performance ratings compared to external workers. However, the researcher also noted that performance differences between internals and externals converged two years after hire, suggesting that external hires may erase initial competency differences after a certain point in time.

Using a similar design as Bidwell (2011), Abdulsallam (2019) investigated differences between internally and externally hired managers at a multinational firm. This study found a similar pattern of results, as internal hires had slightly higher performance ratings (5%)[1] but were not significantly different on leadership quality. Notably, both Bidwell (2011) and Abdulsallam (2019) did not evaluate how the performance differences between internal and external hires impacted unit-level performance. In contrast, DeOrtentiis et al. (2018) examined performance both at the managerial level and the unit-level in retail service units over three years. The researchers found that internal hires received significantly higher performance ratings than external hires, but that the size of the difference was small (d = .15). However, DeOrtentiis et al.

[1] These percentages were calculated by taking the percent difference in the average ratings of performance and leadership between the external and internal hire groups.

(2018) did find that units with internal hires had, on average, 5% greater performance (customer satisfaction) ratings than units led by external hires. Notably, the unit performance of external hires increased faster than internal hires suggesting that their initial skill level advantage decreased over time.

Literature Gaps and Open Research Questions

As reviewed in the previous section, prior research has endeavored to consider the impact of internal and external hires on important organizational outcomes. Whereas Chan's (1996, 2006) studies implied that external hires had higher competency levels than internal hires, more recent work (Bidwell, 2011; DeOrtentiis et al., 2018; Abdulsallam, 2019) used performance ratings to show that internal hires tend to have slightly higher initial performance (and presumably greater competency levels) than external hires. Despite the usefulness of these findings, limitations in prior research challenge our ability to provide definitive conclusions regarding the optimal hiring strategy for organizations.

First, in virtually all of the previous studies comparing internal vs. external hiring preferences, researchers were focused on comparing individual-level differences between external and internal hires on competence or performance. Nevertheless, staffing researchers have often discussed the importance of understanding how hiring decisions at the employee-level cascade upwards to produce *organizational-level* changes in competency composition over time (Ployhart, 2004; Ployhart, 2014; Ployhart & Moliterno, 2011). Only DeOrtentiis et al. (2018) examined whether individual-level differences between internal and external hires corresponded with unit-level performance differences. There is a need for further exploration into whether potential competence differences between internals and externals at the individual-level translate into organizational-level differences. On one hand, it might be the case that the individual-level

hiring decisions directly aggregate to organizational-level outcomes, as is the case in direct consensus (Chan, 1999) and compositional (Kozlowski, 2015) models of group behavior. On the other hand, if a group has differential links between members such that the skill levels for some group members matter more than others, then the impact of hiring decisions can be considered compilational (Mathieu et al., 2014; Kozlowski, 2015), and the impact of individual-level decisions on organizational-level outcomes becomes less intuitive (Kozlowski & Klein, 2000). In their model of team effectiveness, Mathieu et al. (2014) describe how team members often differ in terms of their relative importance towards different tasks. Although this model was focused on small groups, a similar perspective could be taken toward an organization. In such a case, it would be useful to focus on the organizational-level differences in outcomes when different hiring strategies are utilized to avoid committing cross-level fallacies (Ployhart & Moliterno, 2011; Ployhart, 2004), especially when tracking the impact of these hiring decisions over time. Thus, in the current study, I focus on understanding the organizational-level outcomes of different hiring strategies.

A second limitation of prior work is the lack of attention to temporality. Only two of the previously discussed studies examined the longitudinal differences in performance ratings between internal and external hires. Bidwell (2011) found a convergence in performance ratings between internal and external hires after two years. Similarly, DeOrtentiis et al. (2018) found that externally hired managers had lower performing units compared to internally hired managers, but the unit performance of external hires increased exponentially faster than internal hires. Both studies suggest that the initial benefit of hiring internally might dissipate over longer timeframes. However, without extending the timeframe, it is unclear whether the internal advantage holds over time. More specifically, it might be that the advantage internal hires hold

decreases relative to external hires, but never flips in favor of externals. In this case, internal hires would maintain their advantage over time, especially as they grow into their new role and continue to outpace external hires in firm-specific competencies. On the other hand, perhaps the trends observed by Bidwell (2011) and DeOrtentiis et al. (2018) result in a rank order flip, with external hires obtaining an advantage as time increases. In the latter case, the optimal hiring preference might depend on the timeframe in consideration. However, outside of two aforementioned studies, the remaining findings focused on initial performance differences at the individual-level, making it unclear whether a bias towards internal hiring yields consistent organizational advantages over time. Given the lack of clear expectations based on the existing literature, I explore the following research question regarding the impact of hiring preferences over time:

RQ1: What level of preference toward internal or external candidates maximizes organizational competency levels over time?

A third limitation of prior research is a lack of consideration towards multilevel effects. Chan (2006) provided some evidence that competency differences between internals and externals varied across job levels, although this study did not examine skill levels directly. Other studies generally did not consider the impact of job level as a focal variable (e.g., Bidwell, 2011) or focused on a single level (e.g., Abdulsallam, 2019). However, broader organizational research has emphasized the importance of considering multiple levels when assessing relationships between inputs and outputs (Kozlowski & Klein, 2000). For example, managers might be able to leverage their direct reports' competencies (Venkataramani et al., 2014) leading them to have an outsized impact on the organization in comparison to front-line workers. Furthermore, competency levels could grow more rapidly at higher organizational levels due to managers'

scope and visibility into multiple areas of the organization (Daft & Weick, 1984; Nag & Gioia, 2012). For this reason, managerial positions often require different competencies compared to individual contributors (Mumford et al., 2000). Therefore, decisions made at higher levels of the organization may have different degrees of impact on overall organizational outcomes compared to hiring decisions made at lower job levels. In other words, a pure preference for external or internal candidates without respect for job level may not provide an optimal hiring strategy. Instead, competency maximizing strategies may involve specific preferences at specific job levels (e.g., greater preferences for external hires at lower job levels and greater preferences for internal hires at higher job levels).

Moreover, organizations can be structured in ways that result in greater or lower concentrations of headcount across job levels. In their study of organizational structures, Wellman et al. (2020) found that decision-making processes were differentially optimal across organizational structures. Although their study was focused on general group participation and decision-making accuracy, the impact of structure might also hold for specific decision-making contexts – in the current case, hiring decisions. As previously mentioned, each job level may be differentially important. For example, Hollenbeck et al.'s (2012) model of group structure posits that groups can differ along key dimensions (see also Hollenbeck et al. (2015)). Notably, one of those dimensions involves the level of skill differentiation in the organization. If job levels are differentiated based on employee skill levels, then skill levels will be concentrated in different areas of the organization based on the organization's structure. Consequently, different organizational structures will have different initial compositions of competency levels at the upper, lower, or middling job levels. If the optimality of hiring preferences is affected by the job level at which the preference is implemented, then these potential job-level effects may be

exacerbated by the type of organizational structure in which the hiring preference is instituted, because the organizational structure can result in an overrepresentation of employees at a given job level.

The extant literature on hiring preferences does not provide clear expectations regarding the influence of job level and organizational structure on the relationship between hiring preferences and organizational competency levels. Existing studies tend to examine the relationship between individual level characteristics and performance, or at the unit level. However, organizations are multi-unit entities in which individual competencies aggregate based on the configuration of relationships between a manager and their direct reports. The configuration of these relationships is determined by the employee's job level and the organization's structure. Extant research has rarely considered the job level of the employee and has not treated the type of structure as a focal variable, and therefore it is difficult to determine how the interplay between these two variables will affect the relationship between hiring preferences and organizational competency levels. Consequently, I consider the following as research questions:

RQ2a: Does the impact of hiring preference on organizational competency level over time depend on the job level at which the preference is implemented?

RQ2b: Does the impact of hiring preference on organizational competency level over time depend on the organizational structure?

Finally, prior research has not modeled how employees' competency levels can change over time. As previously mentioned, this is a potentially important limitation as rank-order differences can occur when individual-level competency levels change over time, causing differences observed between groups at initial timepoints to provide misleading inferences about

the long-term differences between groups (Ployhart & Haskel, 1998). Although some researchers (e.g., Sackett et al., 2008) suggest that an individual's trait level on job-general competencies (e.g., personality, vocational interest, etc.) cannot be improved through practice effects, organizations can certainly design training programs that increase job-specific competencies such as declarative knowledge and job-specific skills (Kanfer & Ackerman, 1989; Arthur Jr. et al., 2013). For instance, Ackerman's (1987) model of skill acquisition described how newcomers acquire skills on the job to complete tasks and engage these skills using their crystallized intelligence rather than relying on the original individual differences (e.g., personality) that helped them attain the skill. The author's skill acquisition model suggests that although employees have stable individual differences, their level of job-specific skills can increase over time as they gain familiarity with the context-specific tasks required for their job. Although Ackerman (1987) focused on newcomers, internal candidates could similarly benefit from skill acquisition programs that raise their skill level over time. Investment in such programs for internal candidates could therefore help internal candidates increase their competency levels to match or exceed external candidates. This could skew the optimality of hiring preferences in favor of internal applicants, because organizations could potentially promote an internal employee with the same competency level as an external applicant and also retain the employee's firm-specific competencies.

Despite research suggesting that training and skill acquisition result in performance and competency gains for individuals, the role of within-person development has not been considered in existing studies of external/internal hiring. Studies generally note that performance differences decrease over time (Bidwell, 2011; DeOrtentiis et al., 2018), which suggests that there is some developmental process at play, but such processes are not explicitly modeled. It might be

expected that external hires can develop firm-specific competencies as they become internal and that can offset their initial lower competence levels. On the other hand, it might be expected that internal hires who are promoted tend to have faster skill acquisition rates and will subsequently increase in competency levels over time compared to external hires. Incorporating both within-person change (skill acquisition rate) and between-person change (mean employee skill level) has not been considered in the prior empirical studies. Therefore, the third research question evaluates how investment into skill acquisition can affect the impact of hiring preferences.

RQ3: Does the impact of hiring preference on organizational competency level over time depend on the degree of organizational investment in skill acquisition?

CHAPTER 3: BRIDGING GAPS WITH COMPUTATIONAL MODELING

In many ways, the lack of attention to multi-level dynamics and organizational structure in research on hiring preferences is understandable given the practical constraints organizational researchers face when attempting to collect longitudinal data across multiple organizational levels using traditional data collection methods (Kozlowski et al., 2016; Cronin et al., 2011; DeShon, 2012). Given the complexity of the organizational processes underlying dynamic workforce composition (e.g., changes in personnel, employee skill growth, etc.), the need to account for changes in these competencies across organizational levels, and the high-stakes nature of staffing decisions, it is often impractical to manipulate or even observe these processes in a traditional data collection effort (Grant & Wall, 2009). Nevertheless, the lack of conceptual clarity in this area is problematic because it provides relatively few expectations regarding which hiring preference is most beneficial across different organizational factors.

One approach to avoid the limitations of traditional data collection methods in the organizational sciences is to model and manipulate organizational processes computationally to understand how the effects of such processes unfold over time and across levels. Computational modeling is a form of theory formalization that translates theoretical propositions or assumptions into a set of equations or conditional logic (e.g., if-then) statements that are instantiated into computer code and used to run simulations (Harrison et al., 2007; Vancouver & Weinhardt, 2012; Weinhardt & Vancouver, 2012). The output of the simulations is used to determine whether the proposition or assumption set is capable of sufficiently capturing the behavior that theory is supposed to explain (Adner et al., 2009). For this reason, computational models enable researchers to directly evaluate the ability of propositions to generate patterns of behavior that are consistent with an overarching theory (Kozlowski et al., 2018; Harrison et al., 2007).

Additionally, computational models can help guide theoretical development when an overarching theory does not yet exist. In this case, the computational model enables researchers to generate informed expectations regarding a given phenomenon that can be used to craft more specific and useful hypotheses for downstream empirical research. This is particularly useful when multilevel structures (i.e., organizations) and evolving processes (e.g., learning) are involved, because the dynamics of such complex structures are difficult to intuit without the aid of external formal theory (Cronin et al., 2009; DeShon, 2012; Kleinmuntz, 1990). As a result, computational models have been applied across a variety of domains ranging from motivation (e.g., Weinhardt & Vancouver et al., 2012) and citizenship behaviors (Dishop & Awasty, 2023), to team cognition (Grand et al., 2016), and organizational learning (Kane & Alavi, 2007) to build testable theory and help resolve empirical discrepancies. Despite the utility of computational models, it is important to highlight some of the differences between the design of the current study and traditional data collection efforts, especially with respect to the goals of the present study.

The purpose of my dissertation is to identify the hiring conditions that yield the highest organizational competency levels. This goal might be prohibitive using traditional empirical data collection approaches. For example, in an empirical human-subjects investigation, an organization would provide hiring and performance or skills data, generally through an observational design (given the aforementioned constraints of manipulating organizational hiring decisions). The data provided by the organization is almost by definition representative of that organization, at least to a certain extent. However, the process generating the data is unknown, so researchers will often need to estimate a relationship that links the provided target variable (i.e., internal/external status) with the outcome (i.e., performance or competency level). In this

approach, researchers need to partial out variance in the outcome associated with control variables to arrive at an unbiased estimate of the target variable's relationship with the outcome. The direction and magnitude of the relationship is used to validate existing theory that attempts to explain the processes and reasons why the relationship exists (i.e., why internal hires perform better than externals, or vice-versa).

Alternatively, the goal of the current study involves understanding the directional impact of varying the level of one input (hiring preferences) on the level of an output (organizational competency) and represents more of an experimental rather than observational design. This approach allows me to isolate the mechanisms that need to be manipulated, and omitted variables are controlled by being set to the same value (i.e., zero) across conditions. In other words, the model represents an "everything else equal" view except from the manipulated factors. Note that in this design, the processes linking the inputs to outputs are directly coded by the researcher. Therefore, it then becomes critically important to properly specify the model so that it generates high fidelity data. In the current context, the data generating process involves creating an artificial organization that contains employees and candidates holding different competency levels. Some employees leave, others get promoted, and candidates apply for open positions. To build these organizational processes, a set of evidence-based assumptions are required. The following sections review existing literature on competencies, turnover, and backfilling to build a set of assumptions characterizing the behavior of the computational model. The model is then used to simulate organizational outcomes under different internal and external hiring conditions.

CHAPTER 4: DEVELOPING EVIDENCE-BASED ASSUMPTIONS

The goal of my dissertation is to build a computational model that tests the conditions under which hiring internal and external candidates produces maximal organizational competency levels. To do so, the computational model should approximate key organizational processes related to turnover and hiring. Toward these ends, in this chapter, I integrate multiple literatures to ensure the model is able to approximate the organizational processes of interest. First, I differentiate between two types of competencies: generic and firm-specific. I also discuss their relevance for specific organizational positions. Next, I discuss how these competencies can flow out of an organization due to factors that promote turnover. Specifically, I focus on promotion events as triggers for turnover intention when individuals are passed over for turnover, and movement capital as the vehicle for acting on the turnover intention. Finally, I discuss how organizations replace the lost competencies through backfilling the open role. In particular, I discuss how organizations often focus on generic competencies when hiring new employees. Through this literature review, I develop model assumptions that form the core theory of my study and are used to inform how employee competencies, turnover, and hiring are encoded in my model.

Generic and Firm-Specific Competencies

Maximizing the composition of competencies in an organizational workforce is a seminal goal for industrial-organizational psychology (Ployhart et al., 2017). Historically, organizations have measured competencies by evaluating the level of measured knowledge, skills, abilities, and other characteristics of employees in the organization (Campion et al., 2011). However, tracking competencies within an organization is difficult because employees may have different types of competencies and different competencies can be prioritized at different levels in the

organization. For instance, leadership roles tend to prioritize applicants with leadership skills, whereas non-leadership positions tend to value more technical skillsets (Mumford et al., 2000). Additionally, competency levels can decrease when employees leave the organization. Therefore, this section distinguishes between different types of competencies and highlights where specific competencies tend to be situated within the organization.

Types of Competencies

Competencies are defined as the knowledge, skills, abilities, and other characteristics (KSAOs) required to complete jobs (Campion et al., 2011). Knowledge competencies refer to an understanding of facts, processes, and principles needed to complete tasks; skill competencies refer to behaviors necessary to execute tasks; ability competencies primarily refer to general mental abilities (GMA) related to task performance; other characteristics include aspects such as personality, vocational interests, and leadership styles. It is important to emphasize that competencies can refer to specific KSAOs or combinations of KSAOs (Campion et al., 2011); for the purpose of this manuscript, competencies are used to broadly refer to a specific knowledge, skill, ability, or other characteristic, or combinations of KSAOs.

Definition: competencies refer to specific knowledge, skills, abilities, and other characteristics (KSAOs) that employees hold or combinations of KSAOs.

Historically, competencies were considered to be entirely context-specific (Schmidt, 2015). As a result, it was difficult to develop standardized selection practices and identify competencies that were valid across organizations. Schmidt and Hunter (e.g., Schmidt et al., 1979; Schmidt & Hunter, 1977, 1998) shifted this perspective and paved the way for organizational scholars to identify *generic* competencies that are valuable regardless of organizational or industry context. However, researchers also recognize that day-to-day tasks

across similar job roles can vary due to the idiosyncrasies of performing work in a specific organizational context (Ployhart & Moliterno, 2011). Therefore, *firm-specific* competencies are also considered an integral component of an organization's skill composition and a source of competitive advantage among organizations (Barney, 1991; Ployhart, 2012). It is important to differentiate the two types of competencies because they can both impact organizational effectiveness. The following sections elaborate on the distinction between these two types of competencies and their relevance for performance-related outcomes.

Generic Competencies

It is possible to distinguish between generic competencies by differentiating between competencies that are generally required across all jobs (i.e., job-general) and competencies that are specific to a given job type (i.e., job-specific). Job-general competencies can be identified through meta-analytic studies that evaluate the predictive validity of these competencies with job performance across occupational domains. In contrast, job-specific competencies can be identified through competency modeling, in which subject matter experts provide insight into the core competencies required to successfully perform in a given job role. Job-specific competencies can still be considered generic because they are important to the job role regardless of the organization or even the industry context in which the job is performed. However, as the name implies, job-specific competencies are usually important for a specific role and may not be as important for different roles. The following sections provide some examples of job-general and job-specific competencies.

> *Definition: Job-general competences refer to KSAOs or combinations of KSAOs that have some transferability across firms. Job-specific competencies refer to KSAOs or combinations of KSAOs that have some transferability across job positions.*

Job-general Competencies.

General mental ability (GMA) is one of the most discussed job-general competencies. The focus on GMA for evaluating and selecting applicants stretches back over a century (Ployhart et al., 2017). Spearman (1907) developed factor analysis to empirically analyze the structure of intelligence, and found evidence for several abilities. Since then, some researchers have posited the existence of several types of intelligence (e.g., Gardner & Hatch, 1989), but many researchers still represent intelligence as a hierarchical construct with a single factor (*g*) at the top (see Walker, 2020 for a review). The *g* factor corresponds with the characterization of fluid intelligence as a measure of reasoning and problem-solving ability (Gustafsson, 2001). Further refinements of the GMA model have involved examinations of ability clusters underlying the higher-order *g* factor (e.g., McGrew, 2009; Van Der Maas et al., 2006; Vernon, 1965). Although there is not complete consensus on the exact structure of GMA (Schneider & Newman, 2015), a common representation includes three clusters underlying the *g* factor: verbal, quantitative, and spatial (Ones et al., 2017).

Personality is another job-general construct that is consistently related to job performance. Similar to the GMA, the structure of personality remains a topic of debate. Although most researchers agree that personality is composed of a single trait and two meta-traits, there are disagreements as to the number of factors that underlie these meta-traits. A popular representation of personality involves a five-factor model including Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Emotional Stability) traits. However, others have advocated for a six-factor model that includes an Honesty/Humility trait (Ashton & Lee, 2007). Personality traits may also have differential importance based on the specific type of job being considered (Tett & Christiansen, 2007). The

personality trait that tends to show the most generalizable performance validity is Conscientiousness, which tends to have a corrected correlation coefficient of .22 with performance outcomes (Barrick & Mount, 1991; Tett & Christiansen, 2007).

Finally, vocational interests – which refer to individual preferences for types of work activities – are a job-general construct that have received renewed attention over recent years (Hansen & Wiernik, 2018; Nye et al., 2017). A common vocational model is Holland's (1973) RIASEC circumplex, which represents vocational interests in terms of six factors: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. These factors are typically arranged in a circumplex which implies that interests that are more closely linked (e.g., Artistic and Investigative) have stronger correlations than those which are less closely linked (e.g., Realistic and Social; Walker, 2020). Similar to personality traits, vocational interests can be more or less important depending on the type of job being considered. Specifically, when an individual's interests align with the characteristics of a job type, the interests are considered to be more useful competency (Nye et al., 2017). However, interests still maintain some generality in that they are not usually linked to a specific job (e.g., biochemical engineer) as much as they are a job type (e.g., scientist).

Job-specific Competencies.

In contrast to job-general competencies, job-specific competencies can be defined as competencies that are specific to a given job role. However, they are also generic in that these competencies transfer across similar job roles in different organizational and industry contexts. The largest source of such competencies is held on the Occupational Information Network (O*NET). The O*NET database provides a taxonomy of competencies required to perform jobs across a wide range of industries and is maintained and regularly updated by the U.S.

Department of Labor. During the creation of O*NET, Russell et al. (1996) highlighted the need for a common language framework among job descriptions so that employers could quickly identify competencies for similar jobs across different contexts. Peterson et al. (2001) discussed how O*NET maintains the generality needed to characterize broad job descriptions while also maintaining specificity by "... allowing the accumulation of job-specific information, but doing so within the organizing structure of the broader [job] descriptors. For example, job-specific task lists are generated, collected, and archived within the generalized work activities domain, and occupation-specific skills and knowledge areas are organized under cross-job skills and knowledge areas" (p. 456). A comprehensive list of job-specific competencies is beyond the scope of the current study but can be found in the O*NET database nested under broader job categories.

Some examples of job-specific competencies are presented to highlight how even generic competencies can be highly job-specific but still generalizable. For example, competencies for a geospatial computer programmer include "[creating] geospatial software programs using programming languages such as C, C++, and Java" (DiBiase et al., 2010, p. 67). Similarly, requirements for a computer programmer in the Army's information systems department highlight similar competencies such as proficiencies in programming languages such as C++ and Java (D. Hunt & Wilhelm, 2000). Therefore, proficiency with programming languages represents an example of job-specific competency. Specifically, this type of competency is generalizable across vastly different industries (e.g., geospatial research and national defense) but specific to similar job roles (i.e., computer programmer).

Although competencies can remain stable over short intervals, researchers have found that competencies can also change over time. For instance, job-specific competencies can be

increased through training programs that aid skill acquisition (e.g., Ackerman, 1992; Arthur Jr. et al., 1998; Kanfer & Ackerman, 1989). Arthur Jr et al., (2003) provide meta-analytic support for the effectiveness of training programs in boosting job competency levels. In a longitudinal design, Huang et al. (2013) found that within-person transfer of training could increase over time suggesting that individuals could gain competencies over time through training depending on their goal orientation levels. Finally, researchers have also found that individuals with initially low abilities can overtake or meet others with higher starting abilities due to practice with the same task (Keil & Cortina, 2001; Adams, 1957; Alvares & Hulin, 1972), or investment into other tasks become more important over time (Fleishman, 1972; Murphy, 1989). Although these studies did not measure GMA stability specifically, they demonstrated that job-related abilities can also change over time, especially once individuals achieved a moment of understanding regarding their task (i.e., "Eureka! Moment"; Keil & Cortina, 2001). Therefore, it is assumed that generic competencies can be treated as malleable and can specifically increase with task familiarity and experience.

Assumption 1: Generic competencies can increase over time.

Firm-Specific Competencies

In contrast to the literature on generic competencies that has heavily focused on the structure of different competencies (e.g., GMA, personality) and developed large competency taxonomies (e.g., O*NET), the literature on firm-specific competencies pays comparatively less attention to the structure and types of competencies that are considered firm-specific (Ray et al., 2023). To some extent it is impractical to create firm-specific competencies in the same fashion as generic competencies. Wang et al. (2017) suggest that by definition, firm-specific competencies are idiosyncratic, which inhibits a common language framework that can be

achieved even for job-specific generic competencies. As a result, there is a large difference between the conceptualization of generic and firm-specific competencies. Whereas the discussed generic competencies (e.g., personality, GMA, vocational interests) have established psychometric properties and construct validity for each competency, there is not a precise representation of firm-specific competencies (Ployhart & Moliterno, 2011).

Extant literature tends to refer to firm-specific competencies as the extent that employees can leverage the firm's existing knowledge base (Wang et al., 2009) to build novel and non-inimitable solutions (Cohen & Levinthal, 1989; Kogut & Zander, 1992; Nelson & Winter, 1982). However, representations of firm-specific competencies vary widely and can refer to tacit knowledge of organizational routines (Grant, 1996; Polanyi, 1962), firm culture (Wang et al., 2003), or the organization's environment (Lazear, 2009). More specific examples include enhanced coordination due to informal knowledge of different team members and skillsets relating to the use of proprietary software (e.g., Morris et al., 2017), or operating customized equipment (e.g., Døving & Nordhaug, 2002). In an empirical examination of patent companies, Wang et al. (2017) operationalized firm-specific knowledge as the number of times an organization's patent was cited by the employees in the company (see also Mayer et al., 2012 for a similar operationalization). Finally, in a review of human capital resources, Ployhart (2021) suggested that truly firm-specific resources include physical layouts of the job site (e.g., knowledge of where items are located in a retail store), coworker characteristics (e.g., personality and work styles), proprietary technology, or culture (e.g., routines, bureaucratic procedures). For the purposes of this study, I define firm-specific competencies as the knowledge and/or skills that employees hold, which do not generalize to other firms.

Definition: firm-specific competencies refer to knowledge and skills or combinations of knowledge and skills that are non-transferable and are only valuable to a specific organization.

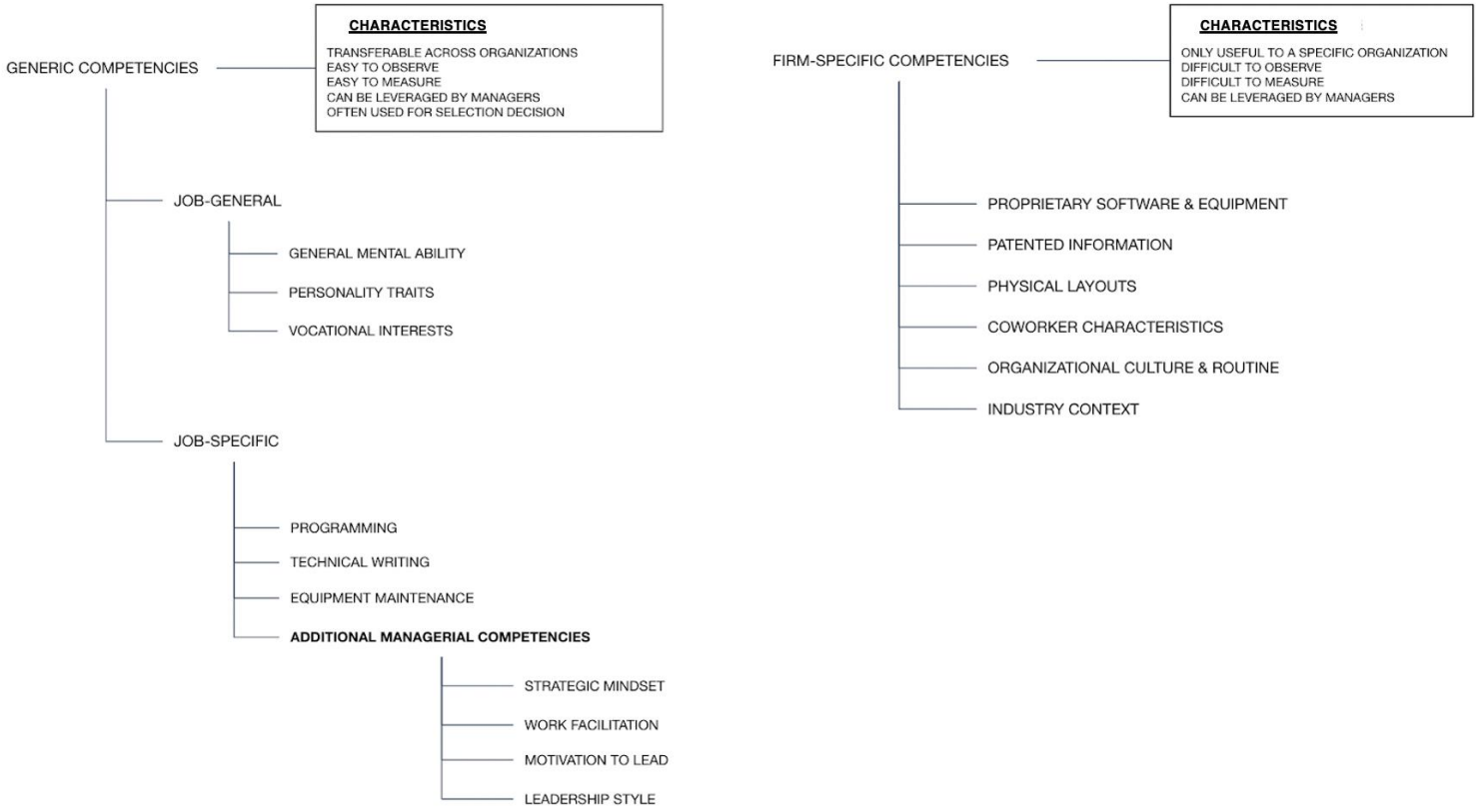
To operationalize firm-specific competencies, researchers have often opted to use variables such as job experience and tenure (Ray et al., 2023). These variables are chosen largely because firm-specific competencies are considered to accumulate over time through exposure to organizational practices (Nyberg et al., 2014). In contrast to research on generic competencies, researchers using firm-specific competencies do not tend to discuss firm-specific competencies as being stable. In other words, the existing literature suggests that firm-specific competencies should increase over time for a given employee in an organization. Nevertheless, some researchers have documented differences in the extent that employees can acquire firm-specific competencies. Specifically, those at higher levels in the organization have a wider view of organizational functions and therefore have greater exposure to organizational idiosyncrasies (Lecuona & Reitzig, 2014). Furthermore, the very function of higher level manager positions can involve acquiring firm-specific knowledge competencies to guide action (Daft & Weick, 1984; Nag & Gioia, 2012). Taken together, there is tentative evidence that suggests firm-specific competencies change over time and their scope is often constrained by the employee's job level.

Assumption 2: Firm-specific competencies increase over time and are constrained by job level.

To summarize this discussion, Figure 1 describes the differences between these competencies by distinguishing between generic and firm-specific competencies. Generic competencies are further parsed into job-general and job-specific competencies. The former refers to competencies such as general mental ability, personality, and vocational interests that

tend to predict performance across job domains, whereas the latter largely refers to skills and behaviors that particularly useful for specific job positions (e.g., programming). Emphasis is placed on job-specific competencies that apply to managers because of their strategic importance to organizational goals. In contrast, firm-specific competencies refer to knowledge areas (e.g., physical locations, coworker characteristics) or skillsets (e.g., operating proprietary software or equipment) that are specific to the firm in which an individual is employed. By definition, all of these competencies are specific to the organization and therefore do not generalize to other companies. It is important to underscore that this list is meant to be illustrative of the differences between firm-specific and generic competencies rather than exhaustive.

Figure 1. Summary of generic and firm-specific competencies.



Importance

As might be expected, competencies are important primarily because they enable individuals to be effective at their jobs. Given that individuals with higher levels of competencies should have higher levels of job performance than those with lower levels, the firm as a whole will demonstrate higher levels of performance when staffed with employees that have high competency levels compared to low competency levels (Schmidt & Hunter, 1998). In general, these claims have been validated. For instance, Ployhart et al. (2006) demonstrated a positive correlation between unit-level personality and performance in a sample of service sector organizations. Kim and Ployhart (2014) evaluated the effectiveness of organizations before and after the 2008 Recession and found that those with greater levels of generic competencies – operationalized in terms of more selective staffing – had higher levels of pre- and post-recession profit growth and productivity. Similarly, Ployhart et al. (2009) defined employee service orientation as an aggregate of personality trait levels and found a positive association with performance.

Wang and colleagues (2017) found similar relationships between firm-specific knowledge (i.e., self-cited patents) and performance based on a sample of research and development firms. Similarly, Wang and Chen (2010) demonstrated positive relationships between firm-specific knowledge and innovation outcomes in manufacturing firms (see also Wang et al., 2009). Other studies using tenure and experience as measurements of firm-specific knowledge (e.g., Berman et al., 2002; Chandler & Lyon, 2009) have also shown similar relationships across a range of occupational contexts (e.g., venture capital groups, basketball teams, etc.). Nevertheless, more research is required to differentiate relationships between firm-specific and generic competencies on performance outcomes. Although there is meta-analytic

evidence that competencies matter for organizational performance (e.g., Crook et al., 2011; Kim & Ployhart, 2014), these studies generally do not differentiate between generic and firm-specific competencies, and therefore some question whether firm-specific competencies are more important than generic competencies (e.g., Nyberg et al., 2018). Despite this concern, I differentiate between firm-specific and generic competencies because understanding the types and levels of competencies held by employees can inform how companies allocate employees to roles. In particular, organizations attempt to allocate roles to individuals with the requisite competencies. The following section discusses how such role allocation occurs and the associated implications.

Managerial Competencies

As discussed in the prior section, job-specific competencies tend to differ widely based on the functional role of the job position. A relevant example is the distinction in required competencies for managers compared to non-managers (i.e., individual contributors). Managerial competencies are important to discuss for a few reasons. First, virtually all organizations contain a leadership structure that separates managers and leaders from frontline workers (i.e., individual contributors) (Jacobs & Lewis, 1992; Jacques, 1976). Additionally, managers occupy a unique position within the organization by connecting employees (Oh et al., 2006). Furthermore, managerial competencies are transferrable across organizations to a certain extent because they are a relatively ubiquitous position (Simon, 1976). In other words, though the specific tasks assigned to individual contributors and managers may differ across areas of the organization (e.g., marketing analyst versus financial analyst), the function of an individual contributor is to complete assigned tasks and the function of a managerial position is to effectively delegate tasks to others (Stogdill & Shartle, 1948). Although the task context may differ based on the

manager's business area, the manager's basic function is "often viewed as a process of social influence" (Kozlowski et al., 2016, p. 21), which involves influencing and directing their subordinates to complete coordinated tasks. The following section discusses how managers can therefore be viewed as connectors between their direct reports, and how this feature results in managerial positions requiring specific competencies that can transfer across firms.

Competency Levels and Job Roles

Manager Position and Function

In their theory of group social capital, Oh and colleagues (2006) discuss how differentiation in an organization's formal or informal structure leads to disconnects (i.e., structural holes) among team members (see also Blau, 1963). These structural holes are filled by managers who regularly interact with and have access to the diverse functional and task skillsets held by their direct reports. In other words, managers represent connectors among team members by virtue of their formal role (Venkataramani et al., 2014). Using social networks terminology, managers serve as *brokers* that leverage their connections among team members to ensure effective delegation of tasks and influence task completion (Graen et al., 1972). For instance, Brass and Krackhardt (1999) discuss executives as connecting different areas of the organization to effectively leverage employee competencies. Similarly, Balkundi et al. (2009) represent managers as brokers of information within a team that use their network position to mitigate conflict and increase team viability. In a series of studies and reviews of the network literature, Burt (e.g., Burt, 1992, 2007; Burt et al., 2013) highlighted how managers could function as brokers due to their role in bridging disconnected team members together, and how serving as a broker positively related to career outcomes (e.g., performance, bonuses, promotions). The characterization of managers as brokers is particularly important because social networks

research represents brokers as integrators of different informational sources (Burt et al., 2013; Burt, 2005; Newman, 2010). As such, managers are often uniquely positioned to integrate and leverage the competencies of their direct reports.

Although managers benefit from brokering multiple competencies (Burt et al., 2013), it is important to consider the effectiveness of their ability to leverage their direct reports' competencies. In an ideal scenario, leaders could directly leverage the competencies their direct reports hold. However, literature on team decision-making would suggest that leaders face difficulties integrating information provided by team members. For instance, both Brehmer and Hagafors (1986) model of staff decision-making and Hollenbeck et al. (1995) model of hierarchical team decision-making propose that leaders must infer team member competencies (e.g., level of expertise) from cues provided by team members. As a result, different sources of bias can occur that distort leaders' perceptions of team member competencies. For instance, direct reports can exaggerate their skillsets to gain favorability. Estimates from the early 2000's suggested that 40-70% of employee resumes were exaggerated and around 30-40% of applicants misrepresented their skills (George et al., 2004; Wood et al., 2007). Although such information can now be more publicly verified, there is still a consistent amount of deception even on public job posting platforms such as LinkedIn (Guillory & Hancock, 2016; Guillory & Hancock, 2012). Importantly, recruiters and hiring managers may not always view such deception as an issue, leading them to hire employees with an unclear skillset (Wood et al., 2007).

In addition to having an unclear understanding of their direct reports' skillsets, managers may not effectively leverage their direct reports' competencies due to a poor working relationship. For instance, leader-member exchange (LMX) asserts that leaders do not adopt a consistent leadership style towards all of their direct reports, and instead hold different

relationships with their subordinates (Liden & Graen, 1980; Kozlowski et al., 2016). That is, some subordinates enjoy high-quality relationships, whereas other direct reports have lower quality relationships, and the quality of these relationships affects performance outcomes (Schriesheim et al., 1999). Evaluating this theory, Gerstner and Day's (1997) initial meta-analysis found that LMX quality was associated with reported and objective performance outcomes (see also Ilies et al., 2009). More recently, Martin et al.'s (2016) meta-analysis also found that LMX quality held a moderately positive relationship with task and citizenship performance. Despite some difference in the magnitude of relationships between LMX quality and performance outcomes based on the operationalization of the construct (Martin et al., 2015), existing research has fairly consistently found positive relationships between LMX quality and performance outcomes.

However, one of the more surprising findings is that leaders and subordinates often share differing views on the quality of their relationship with each other. Gerstner and Day's (1997) meta-analysis found a corrected correlation of .29 for managerial and subordinate self-reports of LMX quality; in a follow-up study, Sin et al. (2009) found the level of agreement between leaders and subordinates depended on the tenure of the relationship and intensity of the dyadic interactions. These studies suggest that information distortion can not only affect the knowledge that a leader has about their direct report's competencies, but also the quality of their working relationship. The latter is also important given that the quality of the working relationship has positive association with performance-related outcomes.

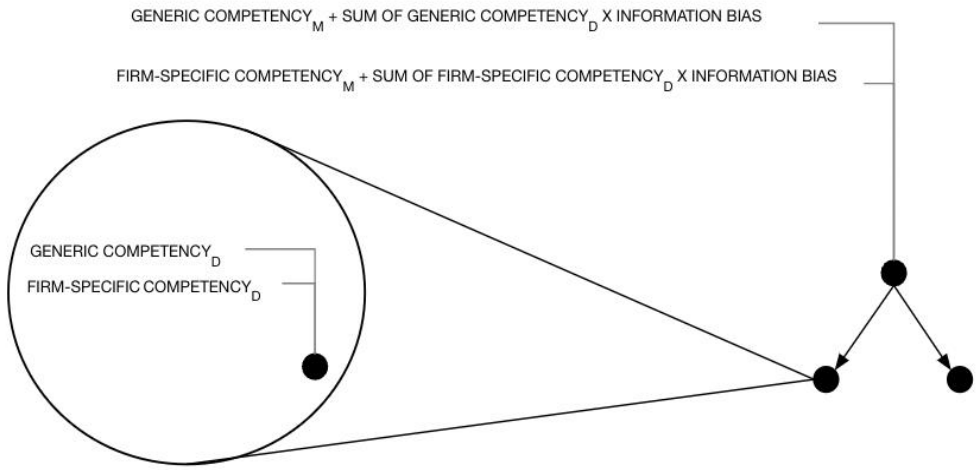
Taken together, extant research suggests that mitigating factors can preclude managers from fully accessing the competencies of their direct reports. In many cases, managers may not be fully aware of the skills that their subordinates possess, and even when they are fully aware, a

poor working relationship can hinder both their performance and their subordinates' performance. Consequently, an assumption from existing research is that managers can only partially leverage their direct reports' competencies in most cases.

Assumption 3: Managers can partially leverage the competencies of their direct reports.

Figure 2 provides a simplified representation of competency access by representing three employees. In this visual, the manager is positioned at the head of the team and connects the two direct reports. Each direct report contains a respective level of generic and firm-specific competencies. The manager's total competency is their own competency levels combined with their direct reports' competencies levels; the latter is downweighted based on the amount of bias in their perception of the direct reports' competencies due to lack of knowledge and/or a poor working relationship.

Figure 2. Accessibility of competencies.



Note: M = manager. D = direct report. Sum of generic/firm-specific competency$_D$ = sum of generic/firm-specific competencies across all direct reports. Information decay = extent that managers can access their direct reports' competencies.

Managerial Competencies

Given the unique position that managers occupy, managerial roles tend to require different competencies than individual contributors. As discussed previously, competencies can be separated into stable (trait) and malleable (behavioral) components. Similarly, research on managerial competencies has identified a wide range of trait-based competencies differentiating leaders from non-leaders. Some of these traits that were helpful at lower job-levels are also relevant for leaders (e.g., conscientiousness, GMA; Judge et al., 2002), whereas other traits (e.g., motivation to lead; Chan & Drasgow, 2001) and working styles (e.g., transactional and transformational leadership; Bass, 1985; Hunt & Conger, 1999) are primarily relevant for leadership roles. Despite evidence for trait-based (and even genetic) determinants of leadership (e.g., Antonakis et al., 2012; Arvey et al., 2006), individual differences do not always fully account for effective leadership. Consequently, a behaviorist perspective emerged that defined

leader competencies in terms of skillsets and behaviors that can be developed over time (Day & Thornton, 2018). As with traits, there is some overlap between leader and non-leader skills, but leadership roles tend to require additional skills that are not required for individual contributor positions.

Mumford et al. (2000) tracked the career progression of 1500 military officers and found that as managers progressed in their career, leadership skills became more important than technical skills. Following this study, Mumford and colleagues (2007) developed and provided evidence for a strataplex theory of leadership that conceptualized skills (cognitive, interpersonal, business, and strategic) as having differential importance depending on the level of an individual's job position. Specifically, cognitive and interpersonal skills were considered important at lower levels, whereas strategic skills (e.g., strategic vision) were only important for executive level positions in the organization. Similarly, McCauley and Van Velsor (2004) provided a taxonomy of leader subskills that included some skills useful to any position (e.g., self-management) and other skills that were more useful for leadership roles (e.g., work facilitation). In a review of leader development, Day and Dragoni (2015) outlined several competencies required for effective leadership and highlighted strategic mindset as a key competency identified across studies (e.g., Dragoni et al., 2011, 2014). Taken together, although some lower job-level competencies are required for managerial roles, other competencies are specific to managerial positions. Therefore, we can assume that managerial roles require an additional set of competencies compared to non-managerial roles.

Assumption 4: Managerial roles require additional competencies compared to non-managerial roles.

The distinction of the discussed competencies as generic job-specific competencies is important because organizations are highly concerned with evaluating employees based on their skillsets during selection. Due to the differences in respective functional characteristics of managerial and non-managerial positions (Jacques, 1978), it is likely that employees are selected for managerial positions based in part on a different set of skills compared to individual contributors.

Summary

The goal of this section is to represent human capital in terms of the composition of competencies within an organization, differentiate these competencies, and broadly discuss the competency requirements for managerial and non-managerial roles. Differences between these competencies are categorized in Figure 1[2]. Generic competencies are knowledge, skills, abilities, and other characteristics that generalize across organizational contexts, and may transfer across job types (i.e., generic job-general) or may be specific to certain job types (i.e., generic job-specific). General mental ability, and other characteristics, such as personality and vocational interests are considered job-general. On the other hand, competencies such as programming and equipment maintenance are specific to certain job types, although their usefulness can generalize across organizations. Although we can distinguish between many jobs in terms of their required competencies, perhaps the most important and pervasive distinction in job function is the manager/non-manager distinction. These are functionally different positions that situate managers within the organizational network in a fashion that enables them to leverage the competencies of their direct reports (Figure 2). As such, managers and non-manager positions

[2] Note that the goal of this table is not to exhaustively summarize all the different types of competencies that exist, but to illustratively categorize different competencies.

tend to require different competencies. In Figure 1, these competencies (e.g., motivation to lead, strategic mindset) are listed as a type of job-specific competencies.

Alternatively, firm-specific competencies can include knowledge of physical layouts, proprietary material (e.g., software or equipment), and other organizational aspects (e.g., culture) that are useful to working in a specific firm (Figure 1). Distinguishing firm-specific from generic competencies is important because the two are generated from different underlying processes. Furthermore, the nature of firm-specific competencies makes them highly unobservable and difficult to signal to employers compared to generic competencies. As a result, organizations tend to focus on generic competencies when evaluating candidates for positions. That is, although both generic and firm-specific competencies are important for organizational performance, organizations tend to focus on generic competencies during hiring.

If organizational workforces were static, then the composition of competencies would remain constant over time. However, the composition of employee competencies can change over time as employees quit and new hires enter the firm. The following section reviews the factors influencing employee turnover, the dilemma organizations face when choosing between internal and external candidates for open roles, and the associated implications for hiring strategy. Following this review, attention is drawn to the limitations of existing research to highlight the need for models that provide more comprehensive hiring strategies.

Flow of Competencies through Turnover and Hiring

The prior section reviewed the different types of competencies that employees can possess. However, organizations can only capitalize on the competencies available to them, which requires an understanding of the competencies held across the organization. Traditionally, organizational researchers have focused on stable group structures and generally treated the composition of competency levels within groups as a static phenomenon (Wolfson et al., 2021). Historically, static perspectives were sufficient as employees enjoyed long-term employment with a single employer; however, job tenure has decreased steadily over the last 50 years (Bidwell, 2013; Farber, 1994; Hollister, 2011), and recent labor shortages have driven historical levels of turnover as employers compete for talent (SHRM, 2022). Under such conditions, static snapshots of human capital will likely not generalize over time.

As employees leave the organization, employers can backfill these open roles with new hires that contain potentially different competency levels, creating changing levels of organizational competence (Mathieu et al., 2014; Nyberg & Ployhart, 2013). Therefore, this section overviews market pressures that pull employees out of the organization, decisions organizations make to push employees to stay or leave, and how organizations tend to replace employees who leave the organization.

Factors influencing Employee Turnover

Understanding voluntary turnover has remained a focus in organizational science for over a century. Early research focused on the cost of turnover (Fisher, 1917), structural policies that could reduce turnover (Local, 1917), and psychological features of exiting employees (e.g., dissatisfaction; Diemer, 1917; Eberle, 1919). In their historical view of turnover research, Hom et al. (2017) mention that such research was primarily atheoretical but served to influence later

models. In particular, the earliest influential theory of turnover was March and Simon's (1958) turnover model that represented turnover as occurring due to two components: job satisfaction (or movement desirability) and job opportunities (or ease of movement). Mobley (1977) expanded this model to represent turnover as a process in which dissatisfied individuals engaged in thoughts of quitting, evaluated the subjective utility of their job search prospects, and then quit the organization. Critically, Mobley's model (e.g., Mobley et al., 1978, 1979) argued that employee decisions to stay and leave are based on the difference between an expected positive utility (e.g., promotions) and negative utility (e.g., lower compensation). Price and colleagues (Mueller & Price, 1990; Price, 1977; Price & Mueller, 1981) expanded the predictors of turnover beyond workplace and labor market characteristics to also include nonwork components such as embeddedness in the community and other kinship responsibilities. Empirical research has largely validated these models, uncovering a vast set of labor market, personal, and organizational predictors of turnover.

In many ways, these theories represented the turnover process as occurring through dissatisfaction. In other words, individuals became dissatisfied with their organization, had lower commitment and greater intention to quit, which was then realized when job prospects appeared. However, Lee and Mitchell (1994) challenged this model by providing a different theoretical representation. In their unfolding model of turnover, the authors represented turnover as occurring through different types of events (called shocks). Some events activated predetermined plans for leaving (e.g., pregnancy). Negative events violated employee values or goals and prompted them to quit on the spot, whereas positive events from other organizations (e.g., unsolicited job offers) resulted in the same action. Although the traditional satisfaction-based

process could occur, Lee and Mitchell suggested that different employee experiences could trigger different paths for leaving.

Despite the heterogeneity in theoretical models of turnover, these models largely suggest that there are events that trigger an individual's intention to quit. In their review of turnover, Hom et al. (2012) distinguish between predictors of turnover intentions, turnover intentions, and turnover itself by noting that "job incumbents wanting better jobs must find and secure alternatives, and failure to do so… can undermine intentions" (p. 832). Taken together, the existing literature suggests that there are events that occur, which can trigger an individual's intention to quit. Moreover, once an individual intends to quit, they must first find a seemingly preferable alternative to their current employment situation before acting on their intentions. The following section focuses on a specific event (promotion) that can trigger turnover intentions and some of the factors that can keep individuals from realizing those intentions.

Promotion Events as a Trigger of Turnover Intentions

Lee and Mitchell (1994) developed their unfolding model of turnover largely to challenge the general consensus that all turnover occurred through a gradual decrease in job satisfaction and commitment. Instead, they emphasized the role of events in spurring turnover intentions. Events may be pre-planned (e.g., pregnancies), or spontaneous with positive (e.g., unsolicited job offer) or negative (e.g., image violations) valences. Although events such as pregnancies or unsolicited job offers may be unavoidable, organizations can enact strategies to mitigate the extent that they trigger turnover intentions through negative events. Some of these events are idiosyncratic (e.g., abusive managers, organizational misconduct, etc.) but other events can be baked into the structural characteristics of the organization. Of interest to organizational research, structural features of the performance evaluation processes can impact individuals'

decisions to turnover. In particular, promotion is a common predictor that has shown negative relationships with turnover intentions and behavior in many meta-analytic studies (Cotton & Tuttle, 1986; Hancock et al., 2017; Hausknecht & Trevor, 2011; Heavey et al., 2013; Jiang et al., 2012).

Promotion is an important event for several reasons. First, it is an event that can help the organization, as a promotion is one way that organizations leverage their internal labor market and elevate competent workers. The origin of promotion as a mechanism for organizations to create talent pipelines stems from historical events such as World Wars I and II, as well as the Great Depression, which left organizations with severe talent shortages (Cappelli & Keller, 2014). To ensure a stable supply of managerial and executive talent, organizations developed internal labor markets that emphasized employee development and promotions (Cappelli, 2009, 2010). External hiring was primarily reserved for entry-level positions, and vacancies were largely filled through internal promotions[3] (Kalleberg & Sorensen, 1979). In doing so, organizations developed formal job ladders that defined the progressions employees could make from entry-level worker to managerial and executive positions (Althauser, 1989; Doeringer & Piore, 1971). The primary advantage of retaining workers lies in the accrual of firm-specific competencies. As previously discussed, individuals can accrue firm-specific competencies over time (Nyberg et al., 2014). By reducing turnovers through promotions, organizations can preserve the composition of firm-specific competencies, which should theoretically increase firm performance (Combs et al., 2006).

[3] Note: promotions are not the only feature of internal labor markets (e.g., job rotations, internships, etc.; Dlugos, 2020). However, promotions are arguably the most salient aspect of an internal labor market (Abdulsallam, 2019), because they both formally and informally increase an employee's status (Johnston & Lee, 2013), as well as their compensation level (Schaubroeck & Lam, 2004).

Additionally, promotions are important for workers as they are positive events for those who get promoted and negative events for those who are not promoted. For employees, a promotion communicates the organization's commitment to employee development (Molloy et al., 2017) and its perception of the employee's competence (Bernhardt & Scoones, 1993), as well as increased financial compensation (World at Work, 2016). In turn, these advantages for promoted workers benefits organizations by reducing turnover. For instance, Huselid (1995) states that "an internal promotion system provides a strong incentive for employees to remain with a firm…" (p. 642). In fact, the conceptualization of promotions as an effective turnover deterrent reaches back to the early 20th century (Slichter, 1919), and as mentioned previously, meta-analytic support for this proposition has been routinely found negative associations between turnover and promotions (e.g., Carson et al., 1994; Cotton & Tuttle, 1986; Griffeth et al., 2000).

However, promoting internal candidates is not cost-free. First, promoting an internal candidate to a new role can require them to gain additional skillsets to handle additional responsibilities (Abdulsallam, 2019). Additionally, promoting an internal candidate will generally involve not promoting other candidates. There is a long line of research suggesting that employees who feel passed over for promotions tend to have reduced satisfaction (Bray et al., 1974; Sirota, 1959; Spector, 1956), can display counterproductive work behaviors (Lam & Schaubroeck, 2000), and become envious of their coworker that was promoted (Schaubroeck & Lam, 2004). In fact, promotions are a particularly important event because of how much they signal an organization's judgment of an employee's competence and the organization's investment in the employee's career. As a result, a lack of a promotion can also be a negative event that triggers turnover intentions.

Assumption 5: Promoting an employee reduces their turnover intention and not promoting an employee increases their turnover intention.

Factors Affecting Conversion of Turnover Intentions to Turnover Behavior

Employees may not necessarily act on their turnover intentions. Generally, employees will leave an organization for an alternative situation that at least appears to be more preferable. However, there are factors which constrain an individual's ability to enter into a more preferable work arrangement. Broader aspects of the labor market such as job availability and the marketability of an employee in the job market can impact the extent that an individual realizes their turnover intentions (Trevor, 2001).

March and Simon's (1958) provided an initial foundation for integrating employee turnover with labor market characteristics by suggesting that turnover was driven by job availability; the authors specifically stated that "when jobs are plentiful, voluntary movement is high; when jobs are scarce, voluntary turnover is small" (p. 100). Although researchers have sometimes used perceptions of alternative job opportunities (e.g., Griffeth & Hom, 1988; Steel & Griffeth, 1989), the availability of jobs has perhaps been most commonly operationalized through unemployment rates (e.g., Hom et al., 1992; Hulin et al., 1985; Schwab, 1991; Steel, 1996; Terborg & Lee, 1984). In general, researchers have historically conceptualized low unemployment rates as tight labor markets with a high number of available jobs, and high unemployment rates as slack labor markets with a low number of available jobs (Hom et al., 1992; Muchinsky & Morrow, 1980). Therefore, unemployment rates are thought to attenuate the relationship between psychological drivers of turnover, with more negative attitudes having less of a relationship on turnover during periods of high unemployment. Carsten and Spector (1987) provided meta-analytic support for this proposition by demonstrating that higher unemployment

rates attenuated the relationship between turnover intention and turnover. Similarly, in a national sample of young adults, Gerhart (1990) found similar results, with turnover intention having no relationship with turnover behavior when the unemployment rate was 15% compared to 5% (see also Gerhart, 1987; Youngblood et al., 1985; Steel, 1996 for similar results).

However, some studies (e.g., Blau & Khan, 1981; Chang, 1989) did not find relationships between unemployment rates and turnover. In a more recent meta-analysis, Hancock et al. (2017) found that attitudinal predictors were actually more correlated with collective turnover when unemployment rates were high. Trevor (2001) suggested that discrepant findings might occur, in part, because of the mixed levels of analysis. Specifically, national unemployment may not be as useful of a predictor as occupation-specific unemployment rates. Given that lower-level (e.g., entry) jobs occupy a much larger share of open positions compared to higher-level (e.g., C-suite) roles, it is likely that aggregate national unemployment is not likely to predict turnover compared to unemployment for a given role. Additionally, Trevor (2001) pointed to the importance of examining movement capital (i.e., marketability of employee skills) as a contributor to the relationship between attitudes and turnover.

The importance of skillsets in relation to employee turnover is fairly entrenched, with many researchers (e.g., Hulin et al., 1985; Jackofsky & Peters, 1983; March & Simon, 1958) conceptualizing an employee's competencies as determinants of their employability on an open job market. In general, employees that are able to signal their competence through education (Gottfredson, 1986; Spence, 1978), promotions (Bernhardt & Scoones, 1993), and other job-related abilities (e.g., cognitive ability or generic skills; Becker, 1975; Fugate et al., 2004; Schmidt et al., 1986) are better able to secure jobs. Consistent with this premise, in a national sample of young adults, Trevor (2001) demonstrated that both movement capital and

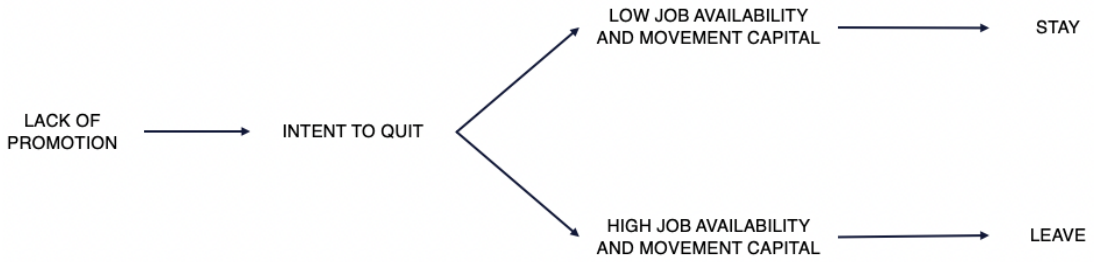
unemployment rates increased the magnitude of the negative relationship between job satisfaction and turnover, such that job satisfaction was more predictive of turnover when unemployment was low and when employees had higher movement capital. Taken together, existing research suggests that when employees wish to leave the organization, job availability and movement capital can impact the extent that employees who wish to leave an organization will actually turnover.

> *Assumption 6: Job availability and competency levels impact the extent that employees realize their intention to quit such that employees are more likely to engage in turnover behavior if there is high job availability for their position and they have high competency levels.*

Summary

Figure 3 provides an illustration of the sequence outlined above. Integrating the unfolding model of turnover with prior attitudinal models, a lack of a promotion serves as a negative event that triggers an intent to quit. This intention is realized based on the availability of jobs and their movement capital (i.e., competency levels), with employees either remaining in the organization or trying to leave. The succession between steps is denoted with arrows marking the sequence from event exposure to retention or turnover.

Figure 3. Turnover sequence at employee-level.



Backfilling Open Roles

Given that organizational personnel will change over time due to turnover, companies are faced with the dilemma of backfilling open roles. A rational organization would evaluate demands-ability fit by comparing the requirements of the role to all competencies (generic and firm-specific) possessed by an employee (Thompson, 1967). However, information asymmetry during the hiring process results in more irrational hiring practices. Specifically, organizations have less information about candidates' competencies compared to the candidates themselves. As a result, candidates must signal their competencies to reduce the information asymmetry (Spence, 1978; Connelly et al., 2011). There are a few reasons to suggest that organizations will focus on generic competencies instead of firm-specific competencies.

First, organizations can engage in opportunistic behavior to extract value from internal candidates who have firm-specific competencies at lower cost. In their study of employee investment in firm-specific knowledge, Wang et al. (2009) note that one reason that employees underinvest in gaining firm-specific knowledge is that employees may not expect their organization to reward such investments. The authors state "because firm-specific human capital has, by definition, limited economic value in alternative settings, employees whose human capital has a substantial firm-specific component are constrained in their transactions with the focal firm" (p. 1267). Similarly, in his study comparing salary and performance of internal and

external employees, Bidwell (2011) drew on theories of incomplete information during the hiring process to posit that "unobservable attributes do not help workers find jobs in other organizations…" (p. 377). In a later study, Wang et al. (2017) noted that investments in firm-specific skills are less valuable in other institutions or other roles, which make specialized employees more susceptible to opportunistic behavior by the firm (e.g., wage cuts, job transfer, dismissal; (Becker, 1975; Williamson, 1985). Given that firm-specific competencies may not be as useful to other organizations, employers can engage in opportunistic behavior that reward generic competencies that are transferrable over firm-specific competencies that are not as transferrable. In support of this proposition, Bidwell (2011) found that organizations compensated external employees more than internal employees when hiring for the same role, despite internal employees showing an initial performance advantage.

In part, organizations engage in this behavior, because generic competencies are more directly observable and therefore easier to reward. Although generic competencies can be signaled on a resume (e.g., existing skillsets) or measure through assessments (e.g., ability or personality), it is much more difficult to convey firm-specific competencies (Bidwell, 2011; Fugate et al., 2004). As discussed in prior sections, existing operationalizations of firm-specific competencies tend to rely on proxies such as employee tenure (e.g., Ray et al., 2023). However, it is difficult for hiring managers to justify selection on the basis of tenure alone, because simply existing in a given role does not transparently convey an accumulated amount of firm-specific knowledge. Although firm-specific knowledge can be demonstrated in specific contexts (e.g., knowledge about a firm's patents; Wang et al., 2009; Wang et al., 2017), direct measurement of firm-specific competencies can often prove difficult. Specifically, Wang et al. (2017) state that "skills and knowledge developed from specialized investments are largely tacit and hard to

observe…" (p. 504). As a result, it can be difficult for employers to assess an internal applicant's firm-specific competencies and tie it into performance evaluation processes. Consequently, when candidates are applying for higher-level roles or are applying to positions in another organization, it can be difficult for hiring managers to incorporate firm-specific knowledge competencies into their hiring decision. Therefore, it is assumed that organizations rank candidates based on generic competencies rather than firm-specific competencies.

Assumption 7: Organizations rank candidates based on generic competencies.

Overall Summary

Table 1 summarizes the set of assumptions and provides further context regarding their inclusion in the model. The complete process model is presented in Figure 4, which describes the sequence of actions characterizing the process of human capital flow over time. In this representation, an organization initially contains employees that hold an initial competency level; the composition of these competencies varies based on the structure of the organization. Employees leave and their respective competencies are lost. The organization then chooses top applicants from the external applicant pool and compares them to the internal applicant pool. A decision is made to select either the external or internal applicant and the selected applicant's competency level is added to the organization. The tenured employees then update their competency levels.

Table 1. List of assumptions and their representation in the model.

Assumption	Key Literature Evidence	Strength	Representation in Model
Assumption 1: Generic competencies can increase over time.	• Training research (e.g., Arthur Jr. et al., 2003; Huang et al., 2013) have shown that job-specific competencies – specifically knowledge and skills – can increase over time due to training programs. • Researchers have shown that abilities can increase over time with task familiarity (e.g., Keil and Cortina, 2001). Similarly, researchers have found that other characteristics (e.g., personality, interests, etc.) can also change over time (e.g., Roberts et al., 2006; Bradburn, 2020).	Strong	Each employee has an initial generic competency level and rate parameter that characterizes how their competency levels change over time.
Assumption 2: Firm-specific competencies increase over time and are constrained by job level.	• Ray et al. (2023) review of firm-specific knowledge and skills literature finds that tenure/experience are almost exclusively used to proxy firm-specific knowledge/skills. • Lecuona and Reitzig (2014) and Nag and Gioia (2012) suggest managers/executives job position provides a wide scope across which they gain tacit knowledge.	Moderate	Each employee has a firm-specific competency level that changes over time proportionally to their job level.

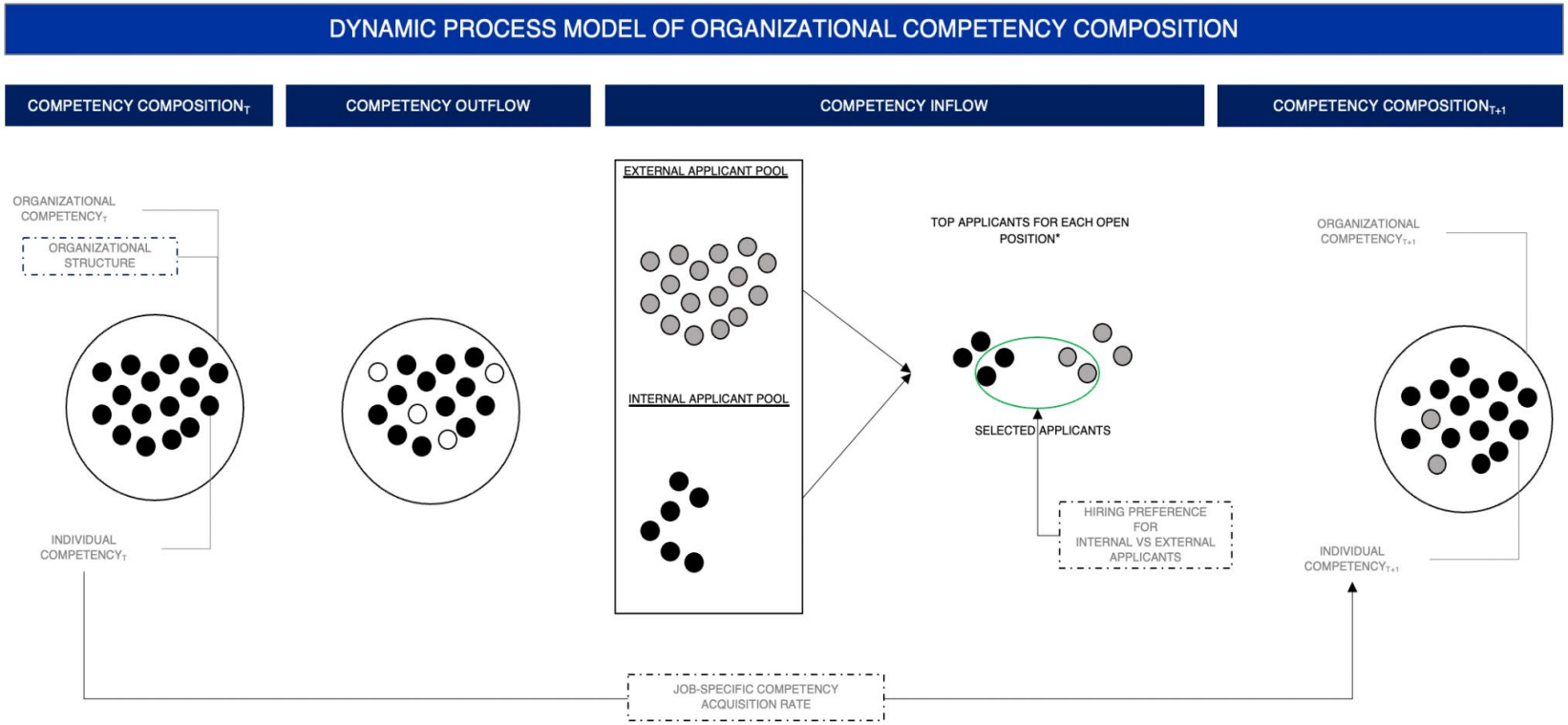
Table 1 (cont'd).

Assumption 3: Managers can partially leverage the competencies of their direct reports.	• Venkataramani et al. (2014); Balkundi et al. (2009); Brass & Krackhardt (1999) represented managers as brokers of information in the organization. • Guillory & Hancock (2012, 2016) found employees misrepresent their skills, limiting the extent managers can leverage their direct reports. • Gerstner and Day (1997); Martin et al. (2016) meta-analyses suggests that LMX impacts performance suggesting that work relationship quality dictates how much direct reports' competencies can be leveraged.	Moderate	Each employee's total competency level includes part of the competency level across their direct reports.
Assumption 4: Managerial roles require additional competencies compared to non-managerial roles.	• Mumford et al. (2000) found evidence that strategic skills were more important than technical skills for upper management (see also Mumford et al. 2007 for similar study). • Day & Dragoni (2015) review of leadership identified key skills required for leaders.	Strong	Manager selection occurs based on a different competency type than non-manager selection.
Assumption 5: Promoting an employee reduces their turnover intention.	• Carson et al., (1994); Cotton & Tuttle, (1986); Griffeth et al., (2000); Hancock et al., (2017) meta-analysis of turnover predictor all find negative association between promotion and turnover.	Strong	Not promoting an employee opens them to leaving. Promoting an employee ensures their retention through the next year.

Table 1 (cont'd).

Assumption 6: Job availability and competency levels will impact whether employees intending to quit actually turnover.	• Trevor (2001) demonstrated a positive relationship between movement capital and turnover. • Carsten and Spector (1987) meta-analysis found that higher unemployment rates attenuated the relationship between turnover intention and turnover behavior. • "when jobs are plentiful, voluntary movement is high; when jobs are scarce, voluntary turnover is small" (March and Simon, 1958, p. 100).	Strong	Employee turnover probability is proportional to their competency level and inversely proportional to their job level.
Assumption 7: Organizations rank candidates based on generic competencies	• Bidwell (2011) found that organizations pay more for external employees who have lower initial performance levels than internal employees. • "the skills and knowledge developed from specialized investments are largely tacit and hard to observe…" (Wang et al., 2017, p. 504; see also, Wang et al., 2009 for a similar proposition).	Moderate	Potential applicants are ranked based on their generic competency levels.

Figure 4. Process model of organizational competency composition.



Note: White circles: open roles. Gray circles: individuals external to organization. Black circles: employees (individuals internal to organization). Dashed boxes: aspects of the process to be varied across simulation conditions. T = timepoint. Individual skill: aggregate of informal and formal skill at individual-level. Organizational skill: aggregate of individual skill. *There are 4 open positions so there are 8 top candidates (4 top internal candidates and 4 top external candidates). When there are not enough internal candidates to satisfy the number of open positions, only the top external candidate is chosen.

CHAPTER 5: METHOD

Simulation Conditions

As discussed above, one benefit of computational modeling is the ability to incorporate a multifaceted set of complex action sequences and evaluate their behavior in an uncontaminated space (Braun et al., 2022). Computational modeling can aid organizational theory by enabling researchers to specify the processes responsible for a given outcome, virtually manipulate these processes to achieve the desired level of the outcome, and thereby provide more specific expectations for empirical research to investigate (Harrison et al., 2007; Kozlowski & Chao, 2018). As a result, computational models can better identify how targeted interventions cause short-term and long-term changes within organizations (Olenick & Dishop, 2022).

As shown in Figure 5, there are three organizational features on which companies can directly intervene. First, organizations can have different preferences for hiring internal and external candidates at different job levels (Bidwell, 2011). Internal candidates have greater levels of firm-specific competencies, but in most cases, external candidates have greater levels of generic competencies (Chan, 2006). At the same time, internal candidates can update their generic competencies over time based on their skill acquisition rate and external candidates can rapidly acquire firm-specific competencies depending on their job level. Similarly, external managers can leverage the capabilities of their potential internal direct reports (Venkataramani et al., 2014). Therefore, the research questions evaluate the impact of manipulating hiring preferences, organizational structure, and skill acquisition rate. These three characteristics will be varied within the computational model to evaluate systematic differences in the short- and long-run composition of competencies. Figure 5 provides pseudocode for the model and describes

how these manipulations will be operationalized within the simulation. Each of the manipulated parameters are discussed in more detail below.

Hiring Preferences

The first research question involves manipulating hiring preferences towards internal and external applicants. As illustrated in Figure 5, when an employee leaves, the organization can backfill the newly opened role with either an internal or external candidate. In the simulation, this occurs by drawing from a binomial distribution. If the draw yields a zero, then an external candidate is selected and if the draw is 1, then an internal candidate is selected. To create a hiring preference, the probability of drawing 1 (i.e., hiring internally) will be systematically varied from a 10 percent probability to a 90 percent probability in increments of 10 percent. It is important to note that this parameter is defined with respect to an internal hire. However, throughout the following sections, any hiring preference parameter value below 50% will be referred to as an "external hiring preference".

Job level and Organizational Structure

The second research question involves varying the hiring preference towards internal or external candidates across the different job levels in the organization. To keep the simulation conditions tractable, a four-level organization was constructed for each of the structural conditions. The organizational structures were drawn from Wellman et al.'s (2020) typology of organizational structures. Pyramid structures contain many low-level employees, and few high-level employees. Leaderless structures contain only employees at the same level. Diamond structures contain most employees in the middle levels, with few employees at high or low levels. Rectangular structures contain an equal number of individuals at each level. Hourglass structures contain large numbers of employees at the ends, but few employees in the middle.

Leaderless structures were excluded because in this structure all individuals are at the same job level. Therefore, there are no internal candidates to promote upward if an employee quits. Table 2 provides a summary of the headcounts at each level for each organizational structure. It is important to emphasize that job level numbers indicate distance from the top of the organizational chart and therefore job levels are essentially reverse coded.

Table 2. Organizational structures and headcounts.

Structure	Headcount
Inverse Pyramid	Level 1: 300 Level 2: 150 Level 3: 75 Level 4: 75 Total: 600
Pyramid	Level 1: 75 Level 2: 150 Level 3: 300 Level 4: 300 Total: 825
Diamond	Level 1: 75 Level 2: 150 Level 3: 75 Level 4: 75 Total: 375
Rectangular	Level 1: 100 Level 2: 100 Level 3: 100 Level 4: 100 Total: 400
Hourglass	Level 1: 150 Level 2: 75 Level 3: 150 Level 4: 150 Total: 525

Note: Note that turnover in the lowest level always required an external replacement given that it was the lowest layer of the organization and no employees at lower levels would exist to promote upwards. Therefore, the focus of the analyses was on the first three levels. To ensure that all replacements at the third level could theoretically be internal, headcount at the fourth (i.e., lowest) level was set equal to the third level.

Investment in Skill Acquisition

The final research question involves manipulating the job-specific skill acquisition rate of the employees within the organization (i.e., potential internal hires). The skill acquisition rate for a given employee is drawn from a normal distribution with a mean of .5 and standard deviation of .1. In this manipulation, an employee's skill acquisition rate will be increased in four conditions to represent no, low, medium, and high investment in skill acquisition programs. Specifically, these conditions will increase employees' person-specific skill acquisition rate by 0%, 25%, 50, and 75%. These increases respectively correspond to training programs yielding zero, small, moderate, and large effect sizes.

Timeframe

Assessing the impact of the proposed manipulations on organizational competency levels over time requires operationalization of the timescales across which the manipulations will occur. The time horizon represents the length of time that the simulation will run. To evaluate the dynamics of hiring preferences on organizational competency levels, the simulation will run for five iterations to represent the 5-year trajectory of competency levels. This will enable evaluation of competency levels across a five-year window from the starting point, which generally mirrors the timeframes for strategic planning set by modern organizations (Deloitte, 2019; McKinsey, 2007).

Organizational Competency

The outcome of interest is organizational-level competence over time. This is represented by the sum of the firm-specific and generic competencies across employees in the organization. This represents a compilational perspective of organizational-level competencies because employee competency levels are scaled based on their importance to the organization (i.e., their span of control) through the inclusion of their direct reports' competency levels (Mathieu et al., 2014). The total metric therefore provides a configural representation of organizational-level competencies (cf. Braun et al., 2020).

Figure 5. Pseudocode for computational model.

1. Create initial organizational structure based on headcounts listed in Table 2.
2. Create external population pool with normal distributions for skill level ~*N*(.5, .1).
3. Initialize internal employee characteristics (generic competency level and autoregressive parameter, firm-specific competency level and autoregressive parameter, tenure, job level, turnover probability). Note: competency levels and autoregressive parameters are drawn from a ~*N*(.5, .1) distribution and are person-specific.
4. Run one burn-in iteration for Time 1.
5. Identify the individuals who were not promoted in the prior timepoint.
    a. Create a turnover probability based on their job level and skill level.
    b. Draw from a binomial distribution based on this turnover level. If 1, then turnover, else stay in the organization.
    c. Create open positions for the employees who left.
6. Create the external applicant pool by sampling 10 applicants from external applicant population for each position and match their generic competency level to the generic competency level range required for the open position. Rank them by their generic competency level and choose the applicant with the highest generic competency level.
7. Create the internal applicant pool by identifying all the employees at the job level immediately below the level of the open position. Rank them by their generic competency level and choose the one with the highest generic competency level.
8. Draw from a binomial distribution based on the hiring preference for the job level. If 1, then internal applicant, else external applicant.
9. Update the organization so that everyone is matched to a supervisor that is one level above them.
10. Increase generic competency and firm specific competency levels for each employee using a linear dynamic equation with person-specific intercepts and autoregressive parameter.
11. Update status so that everyone considered external at the prior timepoint is considered internal.
12. Iterate over the remaining timepoints.

Analytic Strategy

In total there are 9 hiring preference conditions across 3 job levels, 4 skill acquisition conditions, and 3 temporal conditions across 5 organizational structures and 5 timepoints. This results in 9^3x3x4x5x5 total observations. RQ1 was assessed in two ways. First, hiring preferences were averaged across job levels to create an average internal hiring preference variable. The average internal hiring preference and time, as well as their interaction, was used to predict organizational competency levels over time. Notably, these models contained a random intercept to account for different initial starting competency levels across organizational structures.

Given that the hiring conditions were independently and randomly assigned across job levels in a full factorial design, it was informative to parse the independent effects of internal hiring preferences (RQ2A). An additional set of random-intercept models were conducted that regressed organizational competency levels on hiring preferences at each level, and then estimated interaction terms between time and hiring preference at each level. Wald tests were further computed to determine whether the main effects and interactions differed across job levels.

Since organizational structure was also manipulated, job levels may function differently across organizations. Depending on the shape of the structure, headcount may be concentrated at the top, middle, or bottom job level, and this could impact how hiring preferences affected organizational competency levels (RQ2B). The proportion of headcount at each job level was calculated for each of the five organizational structures by dividing the number of employees at a given level by the overall organizational headcount[4]. These proportions were included into a

[4] This variable will be referred to as "proportion of headcount" or "headcount proportion" interchangeably from here onward.

further set of models. In these models, hiring preferences at each job level were interacted with the proportion of headcount at that level, as well as time, to predict organizational competency levels. Because the proportion of headcount is based on the organizational structure, it was not possible to include a random intercept based on structure. Instead, organizational competency levels were standardized across structures by dividing overall organizational competency levels by headcount. The interpretation of the outcome shifts slightly to reflect the competency level on a per-person basis as opposed to the entire organization. However, this still provides the same type of inferences as the previous analyses.

Finally, RQ3 was evaluated by regressing organizational competency levels on hiring preferences and investment in skill acquisition, as well as their interaction. Similar to the prior analyses, these models contained a random intercept for each organizational structure. The following section provides the results of these models. All simulations and data analyses were conducted using R programming. The random-intercept models were tested using the *lmerTest* package and simple slopes for interaction terms were computed using the *reghelper* package.

CHAPTER 6: RESULTS

RQ1 – Interaction with Time

The results for models testing RQ1 are presented in Table 3. Model 1 suggested that across job levels, an average preference for internal hires has a negative impact on organizational competency levels (γ(SE) = -102(52.21); p <.001). However, Model 1A suggested that this negative relationship depends on the timeframe of interest, as the interaction between average internal hiring preference and time was negative (γ(SE) = -93.86(3.04); p <.001). Simple slopes analysis showed that the relationship between internal hiring preferences and organizational competency levels was positive at early timepoints (γ(SE) = 132.64(9.21); p <.001); however, it became negative at later timepoints (γ(SE) = -242.79(6.91); p <.001) (Table 4). Figure 6 presents an illustration of this cross-over interaction, showing that preference for internals initially yielded higher organizational competency levels than preference for externals, but that preference for externals outperformed preference for internals over time.

RQ2A – Interaction with Job Level

To determine whether this effect depended on the job level at which hiring preferences were implemented, Model 2 parsed the average hiring preference into separate variables by job level. These results are presented in Table 5. Again, the results uniformly found that the effect of internal hiring preferences on organizational competency levels was negative (γ(SE) = -32.90(3.01), γ(SE) = -21.14(3.01), and γ(SE) = -47.97(3.01) for job levels 1, 2, and 3, respectively; ps < .001). Additionally, the regression coefficients for hiring preferences at each level were tested for equality through Wald tests. The results suggested that hiring preferences had a stronger effect at the third job level (i.e., the lowest) compared to the second job level (Δ = 26.83; p = .03). When internal hiring preferences at each job level were separately interacted

with time, the results yielded a set of negative coefficients indicating that across job levels, internal hiring preferences had a negative impact on organizational competency levels. The simple slopes analyses found the same pattern of results as in Model 1, showing positive effects for internal hiring preference at early timepoints, but negative effects at later timepoints across job levels (Table 6). Further Wald tests determined that there was no statistical difference between the interaction terms across job levels (Table 7). Figure 7 provides an illustration of these results and shows the same cross-over interaction pattern as Figure 6 for each job level. Taken together, these models provide preliminary answers to RQ1 and RQ2A, in that internal hiring preference is initially positive, but underperforms over time with respect to maximizing competency levels across job levels.

Table 3. Effect of average internal hiring preference and time on organizational competency levels.

	Model 1			Model 1A		
	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*
Intercept	1556.564	300.214	0.007	1392.311	300.231	0.010
Average HP	-102.005	5.221	<.001	226.502	11.841	<.001
Time	142.036	0.456	<.001	188.965	1.586	<.001
Average HP x Time				-93.859	3.041	<.001

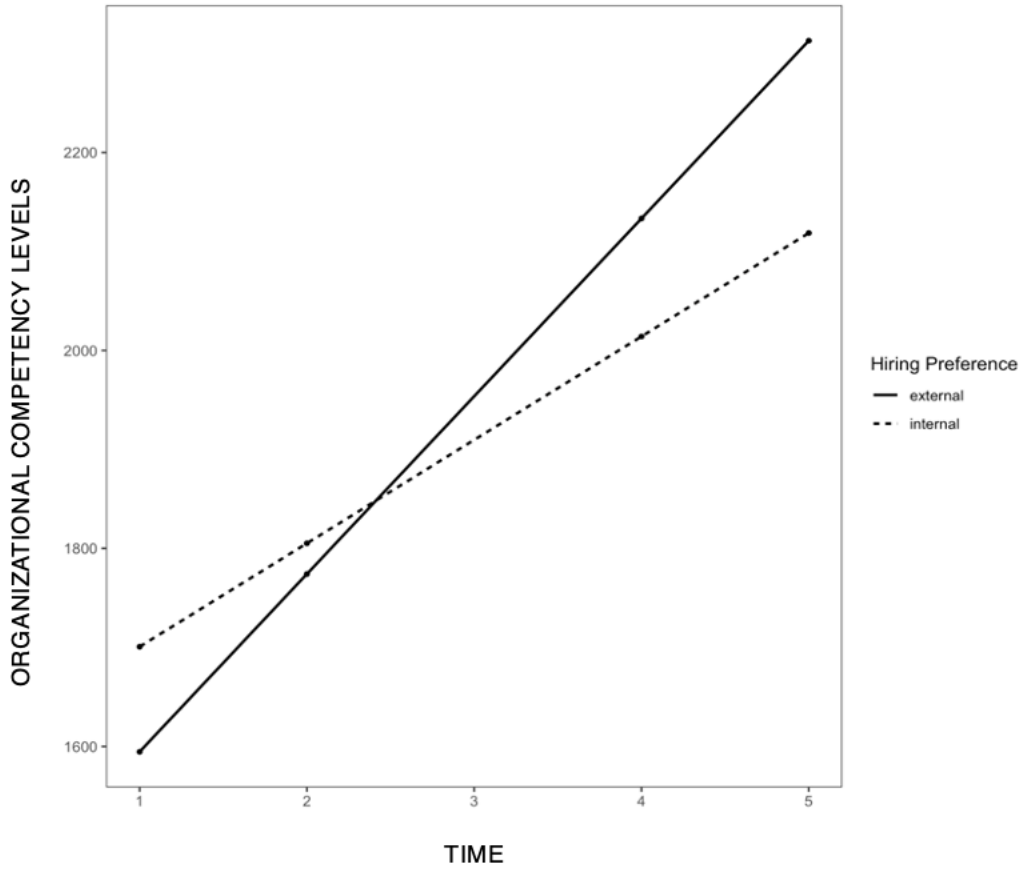
Model Fit Statistics	npar	AIC	BIC	Chisq	*df*	*p*
Model 1	5	1199917	1199964			
Model 1A	6	1198972	1199028	947.78	1	<.001

Note: Average HP = average internal hiring preference.

Table 4. Simple slopes analysis of average hiring preference by time interaction on organizational competency levels.

	Test Estimate	Std. Error	*p*
Time = 1	132.643	9.2057	<.001
Time = 5	-242.793	6.9112	<.001

Figure 6. Simple slopes plot of average hiring preference by time interaction on organizational competency levels.



Note: External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

RQ2B – Interaction with Organizational Structure

In some respects, it was not surprising to find that the negative effect of internal hiring preferences over time did not consistently differ across job levels, because the nature of the job level was also somewhat impacted by the organization's structure. As mentioned previously, the concentration of employees at a given job level was determined by the organizational structure, and therefore, the loss/gain of competency levels at a given level due to hiring could be greater or lower depending on the structure in which the hiring occurred. To assess whether the structure of the organization impacted the pattern of results found in prior models, the proportion of headcount was calculated for each job level across all organizational structures. Results are displayed in Table 8. Models 2B provides the same general inferences as Model 2, except that the coefficients reflect the negative impact of internal hiring preferences on average organizational competency levels rather than the total organizational competency levels. Model 2C found the negative impact of internal hiring preferences on average organizational competency levels was stronger as the proportion of headcount increased (b(SE) = -.21(.04), b(SE) = -.31(.06), b(SE) = -.38(.06) for job levels 1, 2, and 3, respectively; all *p*s <.001). Similarly, Model 2D showed evidence for a three-way interaction between proportion of headcount at each job level, the internal hiring preference, and time for job level 1 (b(SE) = -.12(.02); *p* <.001), job level 2 (b(SE) = -.12(.03); *p* <.001), and job level 3 (b(SE) = -.27(.04); *p* <.001).

The simple slopes analysis in Table 9 examined the effect of internal hiring preferences at early and late timepoints, and across low and high headcount proportions for each level. The results show that for most of the conditions, preference for internal hiring resulted in greater average organizational competency levels at early timepoints, and that this effect was sometimes

stronger when there was a high (for Job Levels 1, 2, and 3 respectively: b(SE) = .10(.02), b(SE) = .10(.02), b(SE) = .10(.02); *p*s <.001) versus low (for job levels 1 and 2, respectively: b(SE) = .07(.01) and b(SE) = .10(.01); *p*s <.001) proportion of headcount. The only exception to this overall pattern was for job level 3. Simple slopes analysis suggested that there was not a statistically significant relationship between internal hiring preferences and average organizational competency levels at early timepoints when headcount was low (b(SE) = .03(.02); $p = .08$). In general, the results maintain the prior findings that there is a positive relationship between internal hiring preferences and organizational competency levels at early timepoints. However, there was not clear evidence to suggest that this positive relationship was weaker or stronger for high and low headcount proportions. Overall, the magnitude of the coefficients appeared to be very similar.

The results of the simple slopes analysis for later timepoints were more conclusive. The negative impact of internal hiring preferences at later timepoints was substantially stronger when the headcount is high for job levels 1, 2, and 3 respectively: b(SE) = -.09(.01), b(SE) = -.08(.01), b(SE) = -.07(.01); *p*s <.001) versus low for job levels 1, 2, and 3 respectively: b(SE) = -.25(.01), b(SE) = -.21(.01), b(SE) = -,27(.01); *p*s <.001). In fact, the magnitude of the negative internal hiring preference coefficients generally differed by 3:1 when comparing across high and low headcount proportion conditions. This suggests that the negative impact of internal hiring has a much greater impact on average organizational competency levels for areas of the organization with greater concentrations of headcount.

Supplementing this analysis, the simple slopes for the three-way interactions were plotted in Figure 8. Given that there are other lower order effects that play a role in the overall outcome levels, the simple slopes plot of predicted outcome levels provides an additional way of

understanding whether the interaction terms produce practical changes in the outcome variable across moderator levels. Interestingly, the simple slopes presented in Figure 8 differ slightly from the prior results. The prior simple slopes analyses showed a clear separation between external and internal hiring for predicted organizational competency levels over time. For instance, in Figure 6, the predicted organizational competency levels for internal hires at the first timepoint were clearly larger than the predicted organizational competency levels for external hires at the first timepoint. Similarly in the same figure, the predicted organizational competency levels for external hires at the final timepoint were clearly larger than the predicted organizational competency levels for internal hires at the final timepoint.

However, in Figure 8, the difference between the predicted average organizational competency levels across external and internal hiring preferences is much smaller. The clearest example of this occurs in the low headcount proportion conditions. In these conditions, the predicted average organizational competency levels at the final timepoints are very similar across both internal and external hiring. This suggests that the benefits of external hiring demonstrated in the prior results might not hold for job levels with a low employee concentration.

In sum, these models show a few clear trends. First, internal hiring appears beneficial at early timepoints, but there is a cross-over after which external hiring results in higher organizational competency levels. Furthermore, there is some evidence to suggest that this pattern does not appear consistently across job levels and structures. When a job level contains a low proportion of the overall headcount, there does not seem to be a practical difference in internal and external hiring. However, when a job level contains a high proportion of the organization's overall headcount, then external hiring appears to outperform internal hiring over time.

Table 5. Effects of hiring preference by job level and time on organizational competency levels.

	Model 2			Model 2A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	2053.688	300.213	0.002	1392.310	300.259	0.010
HP1	-32.900	3.014	< .001	72.058	6.835	<.001
HP2	-21.138	3.014	< .001	84.896	6.835	<.001
HP3	-47.966	3.014	<.001	69.548	6.835	<.001
Time	142.036	0.456	<.001	188.965	1.586	<.001
HP1 x Time				-29.988	1.755	<.001
HP2 x Time				-30.295	1.755	<.001
HP3 x Time				-33.575	1.755	<.001

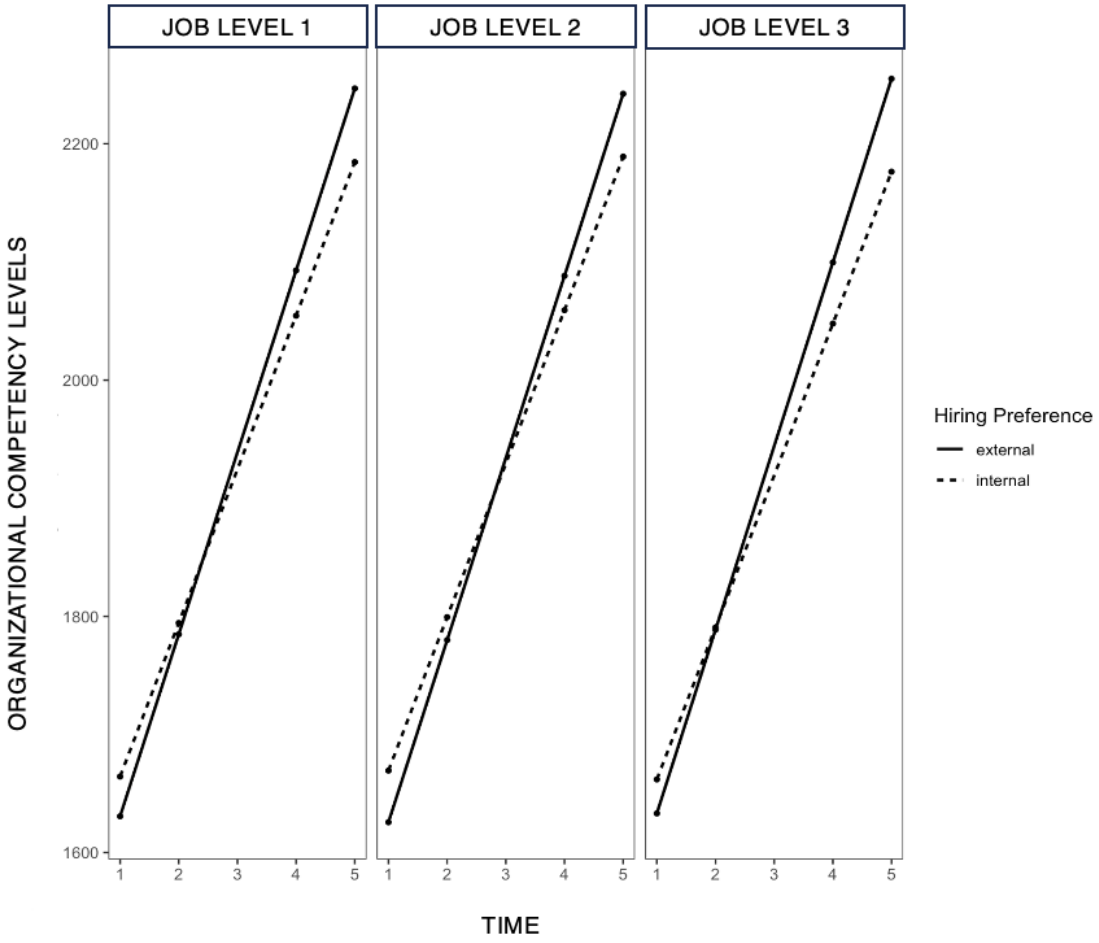
Model Fit Statistics	npar	AIC	BIC	Chisq	*df*	*p*
Model 2	7	1199882	1199947			
Model 2A	10	1198937	1199031	950.79	3	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table 6. Simple slopes analysis of hiring preference by time interaction on organizational competency levels across job levels.

		Test Estimate	Std. Error	*p*
Job Level 1	Time = 1	42.07	14.917	0.005
	Time = 5	-77.883	11.199	<.001
Job Level 2	Time = 1	54.601	14.917	<.001
	Time = 5	-66.581	11.199	<.001
Job Level 3	Time = 1	35.972	14.917	0.016
	Time = 5	-98.329	11.199	<.001

Figure 7. Simple slopes plot of hiring preference by time interaction on organizational competency levels across job levels.



Note: External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Table 7. Wald tests of coefficient equality for hiring preference and hiring preference by time interactions.

Model 2				Model 2A			
Contrast	Difference	SE	*p*	Contrast	Difference	SE	*p*
HP1 vs HP2	-11.763	12.726	0.355	HP1 x Time vs HP2 x Time	0.307	6.968	0.965
HP1 vs HP3	15.066	12.726	0.236	HP1 x Time vs HP3 x Time	3.587	6.968	0.607
HP2 vs HP3	26.829	12.726	0.035	HP2 x Time vs HP3 x Time	3.280	6.968	0.638

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table 8. Effects of hiring preference, time, and headcount proportion across job levels on average organizational competency levels.

	Model 2B			Model 2C			Model 2D		
	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*
Intercept	2.869	0.005	<.001	2.295	0.148	<.001	2.439	0.334	<.001
HP1	-0.066	0.005	<.001	-0.010	0.011	0.364	0.083	0.025	0.001
HP2	-0.046	0.005	<.001	0.029	0.015	0.044	0.127	0.033	<.001
HP3	-0.084	0.005	<.001	0.010	0.016	0.526	-0.017	0.036	0.631
Time	0.259	0.001	<.001	0.259	0.001	<.001	0.218	0.086	0.011
PROP HC L1				0.143	0.144	0.322	-0.357	0.327	0.274
PROP HC L2				1.123	0.158	<.001	0.832	0.357	0.020
PROP HC L3				1.054	0.289	<.001	0.053	0.654	0.936
HP1 x PROP HC L1				-0.210	0.037	<.001	0.215	0.083	0.010
HP2 x PROP HC L2				-0.309	0.056	<.001	0.124	0.127	0.328
HP3 x PROP HC L3				-0.382	0.061	<.001	0.563	0.137	<.001
PROP HC L1 x Time							0.143	0.084	0.088
PROP HC L2 x Time							0.083	0.092	0.364
PROP HC L3 x Time							0.286	0.168	0.088
HP1 x Time							-0.026	0.006	<.001
HP2 x Time							-0.028	0.008	0.001
HP3 x Time							0.008	0.009	0.397
HP1 x PROP HC L1 x Time							-0.121	0.021	<.001

Table 8 (cont'd).

HP2 x PROP HC L2 x Time			-0.124	0.033	<.001
HP3 x PROP HC L3 x Time			-0.270	0.035	<.001

Model Fit Statistics	*df*	F	*p*
MODEL 2B			
MODEL 2C	6	514.72	<.001
MODEL 2C			
MODEL 2D	9	198.1	<.001

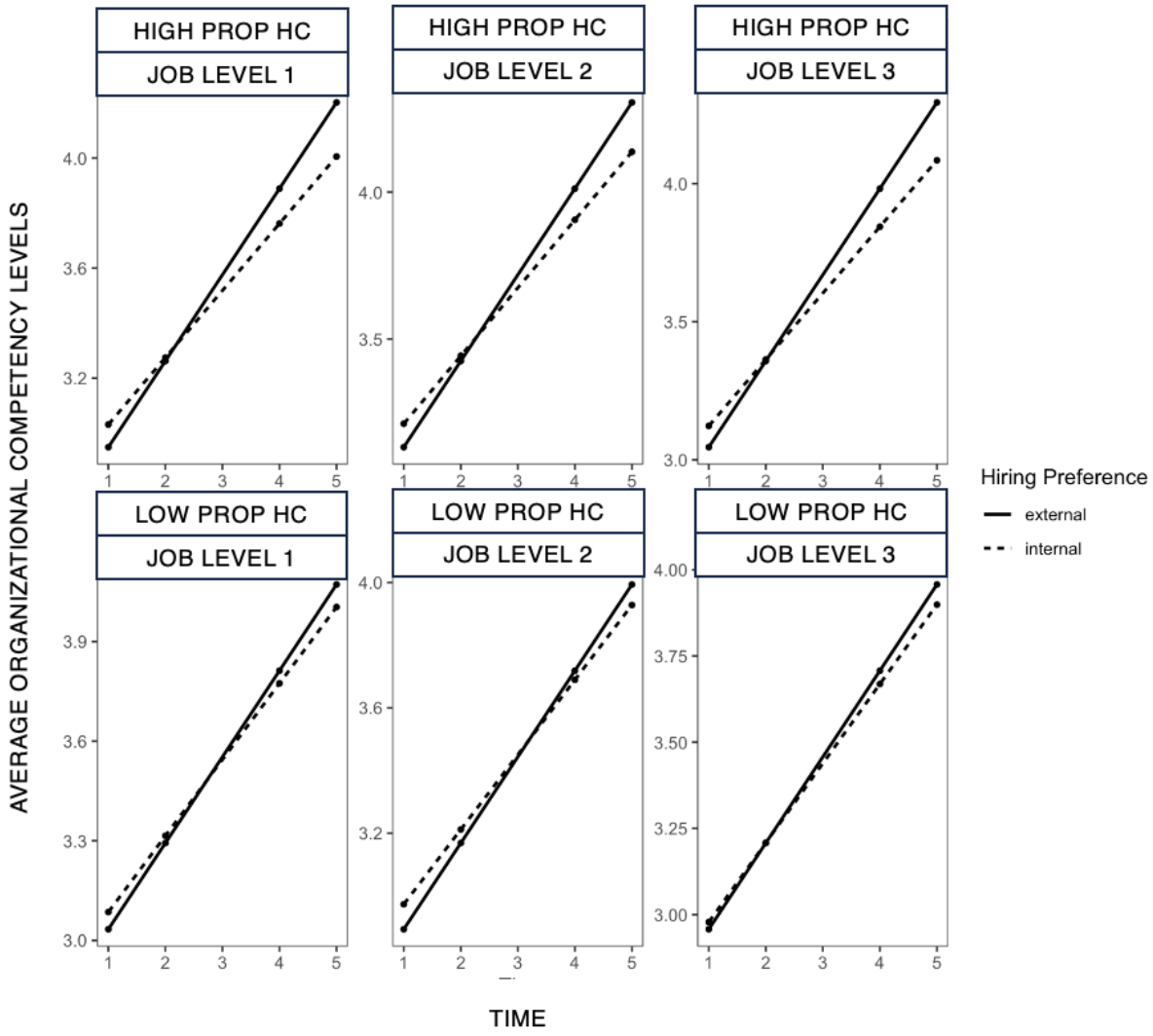
Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3. PROP HC L1 = proportion of headcount at job level 1. PROP HC L2 = proportion of headcount at job level 2. PROP HC L3 = proportion of headcount at job level 3.

Table 9. Simple slopes analysis of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.

			Test Estimate	Std. Error	*p*
Job Level 1	Time = 1	PROP HC = Low	0.065	0.014	<.001
	Time = 1	PROP HC = High	0.103	0.017	<.001
	Time = 5	PROP HC = Low	-0.085	0.011	<.001
	Time = 5	PROP HC = High	-0.246	0.013	<.001
Job Level 2	Time = 1	PROP HC = Low	0.100	0.013	<.001
	Time = 1	PROP HC = High	0.100	0.018	<.001
	Time = 5	PROP HC = Low	-0.083	0.010	<.001
	Time = 5	PROP HC = High	-0.210	0.013	<.001
Job Level 3	Time = 1	PROP HC = Low	0.027	0.016	0.081
	Time = 1	PROP HC = High	0.097	0.015	<.001
	Time = 5	PROP HC = Low	-0.077	0.012	<.001
	Time = 5	PROP HC = High	-0.265	0.011	<.001

Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level.

Figure 8. Simple slopes plot of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.



Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level. External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

RQ3 – Interaction with Skill Acquisition Programs

Finally, RQ3 sought to understand whether the benefits of internal hiring might be increased when organizations invest in programs that increase employees' skills. The results of these models are presented in Table 10. The main effects in Model 3 provide expected results, with internal hiring preferences and skill acquisition investment respectively yielding negative (γ(SE) = -102.01 (3.14), p <.001) and positive (γ(SE) = 658.22(1.67), p <.001) impacts on organizational competency levels. The interaction in Model 3A, however, is slightly counter to the thought that the benefits of internal hiring will be amplified by investment in skill acquisition programs for internal employees. The interaction term is negative (γ(SE) = -152.27 (11.21), p <.001), and simple slopes analysis (Table 11) revealed that the negative relationship between average hiring preferences and organizational competency levels actually increased when investment in skill acquisition for internal employees was high (γ(SE) = -159.11(5.25), p <.001) compared to low (γ(SE) = -44.91(5.25), p <.001). Figure 9 shows that the negative relationship between internal hiring preferences and organizational competency levels is steeper when there is a high investment in skill acquisition compared to a low investment in skill acquisition. The implications of these findings are further unpacked in the following section.

Table 10. Effects of average internal hiring preference and investment in skill acquisition on organizational competency levels.

	Model 3			Model 3A		
	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*
Intercept	1309.730	300.192	0.012	1281.1803	300.208	0.013
Average HP	-102.005	3.138	<.001	-44.9046	5.245	<.001
SK ACQ	658.222	1.673	<.001	734.3559	5.851	<.001
Time	142.036	0.274	<.001	142.0355	0.274	<.001
Average HP x SK ACQ				-152.2669	11.214	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	*df*	*p*
Model 3	6	1110835	1110891			
Model 3A	7	1110652	1110718	184.19	1	<.001

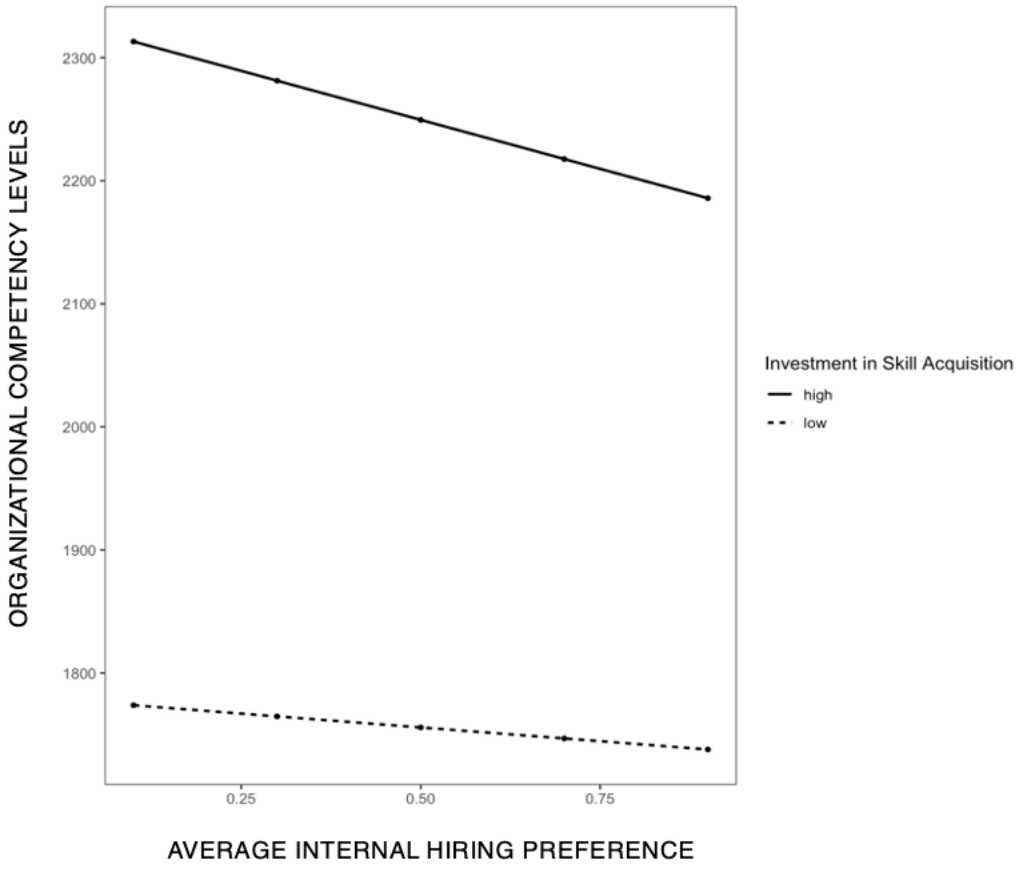
Note: Average HP = average internal hiring preference. SK ACQ = level of investment in skill acquisition programs.

Table 11. Simple slopes analysis of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.

	Test Estimate	Std. Error	*p*
Low Investment	-44.905	5.245	<.001
High Investment	-159.105	5.245	<.001

Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Figure 9. Simple slopes plot of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.



Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Robustness Checks

As with any theoretical model, a computational model represents a simplified explanation of the world. Therefore, it is important that the assumptions used to create the model are realistic enough to represent the processes that it is designed to capture (Epstein, 1999). One way to evaluate the criticality of model assumptions is to perform robustness checks that identify the sensitivity of simulation results to different parameterizations (Harrison et al., 2007; Vancouver et al., 2020). In traditional statistical models, this often results in robustness analyses that focus on different model specifications and data processing decisions (Weston et al., 2019; Steegen et al., 2016). In a computational model, where underlying processes are explicitly specified, robustness checks are often performed on the assumptions/propositions used to create the simulations (Kozlowski et al., 2016).

In the current study, the model assumptions are all drawn from existing literature, and therefore, there is some degree of empirical support for their instantiation in the model. However, some of the assumptions only have moderate support and therefore needed to be revisited. Specifically, there were three assumptions that held moderate support. Assumption 2 regarding the bounding of firm-specific competencies, Assumption 3 regarding the ability of managers to leverage direct reports' skillsets, and Assumption 7 regarding the use of generic competencies to select candidates were re-visited to understand whether model results were dependent on their inclusion. The importance of Assumption 2 was tested by setting all employees to have an equal theoretical maximum level of firm-specific competency across job levels. The importance of Assumption 3 was tested by setting managers as unable to access the skill level of their direct reports. Although making managers unable to access their direct report's skill level is not necessarily realistic, this condition was worth testing because leaderless teams

and organizational structures may be structured so that every employee is independent (Wellman et al., 2020). Finally, the importance of Assumption 7 was tested by using firm-specific competencies to rank internal applicants as well as their generic competencies. This is also not necessarily realistic given the difficulties that organizations possess evaluating firm-specific competencies and rewarding employees who have firm-specific competencies (Wang et al., 2009, 2010, 2017). However, it was worth testing to understand what strategies companies should take if they were able to operate in the ideal setting of selecting internal applicants based on both their firm-specific and generic competencies. The results of all robustness checks are presented in the appendix.

The models testing RQ1 yielded similar findings to the original simulation across all robustness checks. There was evidence for a cross-over effect with internal hiring preferences yielding higher organizational competency levels at early timepoints, and external hiring preferences yielding higher organizational competency levels at later timepoints (Figures A1 and A4). However, it is important to note that for the robustness check on Assumption 7, the cross-over occurred around the fourth timepoint as opposed to the second timepoint in the original simulation (Figure A7).

Additionally, for RQ2A, the models across robustness checks were relatively consistent with the original findings. The primary test of RQ2A in the original model found that the magnitude of the cross-over effect did not differ across job levels. Similarly, in the robustness checks, the magnitude of this cross-over effect did not significantly differ across job levels (Tables A2). However, there were a few differences across the robustness checks for RQ2B and RQ3 compared to the original simulation.

With respect to RQ2B, the robustness check on Assumption 3 found little evidence for a three-way interaction (Table A15). This suggests that cross-over effect did not depend on whether headcount was concentrated at a given level. To a large extent, this makes sense. Once managers cannot access their direct report's skills, job levels do not have much of an impact, and the magnitude of the cross-over should therefore not matter whether headcount is more or less concentrated at a given job level.

Additionally, for the robustness check on Assumption 7, the magnitude of the cross-over interaction only differed across headcount proportions at the lowest job level. In the original simulation, the cross-over interaction had a greater magnitude at a given job level when headcount was concentrated at that level. In this version, the cross-over interaction had a greater magnitude when headcount was concentrated at that level only for job level 3 (Table A24). At the other job levels, it did not appear to matter whether or not headcount was concentrated at that level. It is difficult to determine why this was the case. To better understand the impact of headcount proportions on the relationship between hiring preferences and organizational competency preferences over time, the predicted average organizational competency levels over time were plotted across moderator levels based on the estimated regression equation (Figure A8). The results showed that the difference between external and internal hiring preferences at the upper job levels was much smaller than the difference between external and internal hiring preferences at the lower job levels over time. This is likely because the firm-specific competencies have relatively higher value at upper levels compared to lower levels. Therefore, at upper job levels, internal hires can better supplement any generic competency differences with their advantage in firm-specific competencies. Nevertheless, it bears noting that this mitigation

likely occurs primarily within the timeframe of interest. Extrapolating the simple slopes outward, the external advantage is still likely to emerge after the 5-year mark.

With respect to RQ3, the robustness checks on Assumptions 2 and 3 yielded the same outcome as the original simulation. In these conditions, the negative effect of internal hiring preferences on organizational competency scores was stronger when there was greater investment in skill acquisition (Tables A5, A14, A23). However, the robustness check on Assumption 7 did not find an interaction effect of skill acquisition investment and hiring preferences (Table A26). This suggests that when organizations select internal applicants based on firm-specific competencies and generic competencies, skill investment may not result in as apparent of an external hire advantage compared to when organizations select on generic competencies alone.

In summary, the primary differences between the robustness checks and the original simulation occur with respect to the three-way interaction between internal hiring preferences, headcount proportion, and time. When managers do not have access to their direct reports, the headcount proportion does not matter. When organizations select based on firm-specific and generic competencies, it takes longer for the benefits of external hiring to appear at the upper job levels, because firm-specific competencies at these levels can offset any differences in generic competencies. This also appears to play a role in skill acquisition investment, as the original findings showed that the negative effects of internal hiring were exacerbated by higher levels of skill acquisition investment. This does not appear to hold when organizations are selecting internal applicants based on both firm-specific and generic competencies. Taken together, the results of the robustness checks suggest that the original findings are partially dependent on the original parameterization. Internal hiring preferences yielded higher organizational competency

levels at early timepoints, whereas external hiring preferences yielded higher organizational competency levels at later timepoints. However, when this cross-over occurred and the extent that it differed across headcount proportions depended partially on the selection process.

CHAPTER 7: DISCUSSION

The current study provided evidence for a complex pattern of relationships between hiring preferences and organizational competency levels. Specifically, the results replicated past findings (e.g., Bidwell, 2011; DeOrtentiis et al., 2018) regarding the *initial* benefit of hiring internally compared to externally. However, the results also showed that preferences for external hiring outperformed preferences for internal hiring as time increased. This suggests there is a long-term external hire advantage. Additionally, results suggested that the external hire advantage was conditional on the level of employee concentration. When employees were highly concentrated within a job level, the benefits of having an external hiring preference were clear. In contrast, when a job level contained a low proportion of the overall employee headcount, there was no clear separation between the two hiring preferences in terms of predicted organizational competency levels. Moreover, the benefits of hiring externally actually increased when there was greater investment for skill acquisition programs for internal employees.

Contributions to Organizational Theory and Research

The results of this dissertation offer several implications for organizational theory and research. One of the clearest implications from the present study is the need to consider the temporal window during which a hiring initiative takes place. Organizational research, and staffing research in particular, has often been limited by cross-sectional designs that do not incorporate temporal effects (Kozlowski, 2015; Ployhart et al., 2017; Zaheer et al., 1999). Extant research has generally found that internal hires tend to outperform external hires; however, these studies are generally based on the first year of employment (Bidwell, 2011; Abdulsallam, 2019). The current study replicated these findings by showing that a hiring preference for internal hires results in greater organizational competency levels compared to a preference for external hires in

the first year. However, the current study accounts for changes in competency levels that occur between-person (i.e., changes in personnel) as well as within-person (e.g., through internal development programs). This approach revealed a cross-over interaction such that external hiring preferences yielded greater organizational competency levels than internal hiring preferences at later timepoints. This suggests that if an organization sets business goals over a longer time span, then an external hiring strategy will generate greater return on organizational competency in the long run compared to an internal hiring strategy. The attention to timeframes is important because existing theory on staffing and selection tends to focus on selecting the optimal individuals in the current context, and assumes the optimal decision generalizes over time. In a recent study, Shamsollahi and colleagues (2022) showed how the short-run impact of organizational initiatives might not generalize in the long-run. Specifically, the authors showed how initiatives might have minimal long-run impact if the initiatives are not sustained over time. Adding to this perspective, the current study shows that hiring strategies that are positive in the short-run, may actually have a negative impact over time compared to other strategies. With respect to organizational competency levels, whether external or internal hires are more optimal depends on whether the organization makes evaluations in the short-run or long-run.

A primary reason for this effect is the fact that external employees become internal after a certain period of socialization. Therefore, external hires can also provide the benefits of hiring internally, provided that the organization is willing to wait the time needed for them to become "internal". This is a slightly different perspective from prior research that tends to treat employees as internals and externals as fixed rather than changing over time. The conversion from external to internal over time also creates an unintended consequence when organizations offer programs to develop internal employees. In theory, such programs have the potential to

help bolster internal hires' skill levels to match external candidates. In conjunction with the fact that internal hires tend to have much higher firm-specific competency levels compared to externals (Nyberg et al., 2018), the overall competency level of an organization with a high percentage of internal hires should be greater than those with external hires, when there is a high level of skill acquisition investment. However, when external hires become internal (after the first year, in the current study), they can also gain access to these skill acquisition programs. As a result, if organizations are hiring external candidates that – on average – have higher generic competencies than internal candidates, then investment into skill acquisition programs can potentially have the counterintuitive effect of amplifying the benefits of external hiring as opposed to internal hiring. The simulation results showed that the negative effect of internal hiring was actually stronger as investment into skill acquisition programs for employees increased.

Such unintended consequences are common in complex systems such as organizations, especially when there is change over time across levels of analysis (Olenick & Dishop, 2021). To that end, the results suggest that it is important to start building staffing theory that treats labels such as "internal" or "external" as fluid rather than fixed categories. This approach is more consistent with theories that treat organizations as dynamic systems (e.g., Katz & Kahn, 1971; Kozlowski & Klein, 2000). In such paradigms, internal and external labels would be considered "stocks" that employees would flow through (i.e., into and out of), depending on the length of socialization required for an internal employee to become external. Notably, it becomes increasingly difficult to intuit the long-run behavior of such systems as more complexity is added (Dishop et al., 2022). Simulating the dynamics of both between- and within-employee change can help make such counterintuitive outcomes clearer (Braun et al., 2022).

Finally, the current study found that the structure of the organization and job level at which the hiring preference occurred played a role in determining whether internal or external hiring preferences were more impactful. Most studies comparing external to internal hires also typically represent individuals as having a uniform impact on organizational outcomes (e.g., Bidwell, 2011). However, individuals are differentially linked together in organizations such that their impact may not be the same depending on their job level (Mathieu et al., 2014). By drawing from social capital research (e.g., Oh et al., 2006) and incorporating network effects, my computational model provides a configural representation of organizations that can more realistically model the job levels at which hiring preferences are more or less impactful. Specifically, the benefits of external hiring preferences appeared strongest wherever headcount was concentrated. In fact, there was little separation between external and internal hiring preferences in terms of predicted average organizational competency levels, in job levels of the organization that contained a low proportion of overall headcount. This presents some theoretical considerations for organizations and researchers. Specifically, extant literature has been largely agnostic regarding whether optimal hiring decisions generalize across job levels. Although prior studies have shown that structure can impact other group outcomes such as decision-making (Wellman et al., 2020), this line of research tends to view different structures as distinct from one another. Instead, the current study presents structures as part of a continuum that differ on the proportion of headcount across job levels. In doing so, the results of the current study help provide more generalizable insights that are not necessarily limited to a specific structure and move the literature from contextualizing findings to specific structures and instead focus on the underlying structural mechanisms responsible for differences across structures.

The results of the present study suggest that the impact of a hire may be more or less felt depending on the distribution of headcount in the organization. This likely occurs because optimal decisions are made in larger areas of the organization can supplement the negative effects of sub-optimal hiring decisions in smaller areas of the organization. For example, hiring employees with greater skill levels in large parts of the organization, will logically tend to offset the loss of replacing high skilled employees with lower skilled employees in smaller parts of the organization. This is also apparent when turnover is considered. If employees in higher job levels have greater likelihood of turnover due to higher competency levels, then it might seem that the impact of a hiring strategy would increase with job levels. However, if that area of the organization contains a relatively low proportion of overall headcount, then the loss of skills in that area may still be relatively minimal compared to the larger areas of the organization and may therefore have little effect on the overall organizational competency levels.

Overall, the provided results suggest that the distribution of competency levels across job level rather than the rank of a job level can affect whether a hiring decision makes an impact on overall competency levels. In the current study, this means that external hiring or internal hiring might not matter if the job level contains a relatively low proportion of the overall headcount. Organizations can still achieve desired goals of promotion and internal hiring by focusing movement at such levels. Furthermore, this could also have implications not just for internal and external hiring, but whenever there are found to be differences in competency levels between groups. Nevertheless, further research is required to determine whether the findings of the current study generalize to other groups with expected competency level differences.

Practical Implications

The results of the simulation provide a few implications for organizational practice as well. The primary implication for organizations is that external hiring yields greater expected competency levels over time for the largest areas of the company. As previously discussed, the results suggest that hiring strategies should be chosen based on the timeframe over which business goals need to be achieved. Internal hiring preferences generally result in greater organizational competency levels than external hiring preferences in the short-term, but external hiring preferences generally result in greater organizational competency levels than external hiring preferences in the long-term. Additionally, the results suggest tailoring the hiring strategy based on the structure of the organization. For example, in pyramidal organizations, the simulation suggests that external hiring may be most impactful at the lowest levels of the organization, whereas for diamond shaped organizations, external hiring can confer the greatest benefits in the middle of the organization. In general, organizations should consider where their headcount is most concentrated and tailor external hiring to those locations when possible. However, as previously mentioned, organizations may also wish to set internal movement goals as part of a broader human resource strategy or if they want to maximize on some other outcome besides competency levels (Sonnenfeld & Peiperl, 1988). If this is the case, and they want to minimize the potential negative effects of internal hiring on organizational competency levels over time, then the results of the current study suggest focusing on internal hiring within areas of the organization that represent the lowest headcount proportion in the overall organization.

Finally, the results of the skill acquisition investment provide some implications for organizations seeking to supplement their internal applicant pool. Although the results of the current study suggested that greater investment actually strengthened the negative relationship

between organizational competency levels and internal hiring, we can extrapolate some changes to the simulation that could change this interaction. Specifically, it is likely that if access to skill acquisition programs were limited to internal applicants of a specific tenure, it would benefit the internal applicants with higher tenure levels, and therefore would not enable external hires to gain the same benefits as internal hires after the first year. Similar practices are often implemented with respect to financial development programs such as 401k matching, stock vesting, and pensions to reward tenure and retention (Bryant & Allen, 2013; Brandes et al., 2003). If such practices were applied to skill development programs, perhaps skill acquisition investment would result in a positive relationship between internal hiring and organizational competency levels for a longer timeframe than in the current study.

Nevertheless, organizations may wish to still offer some skill acquisition programs as part of their broader applicant attraction strategy (Zaharee et al., 2018). Therefore, it would likely be necessary to increase the number of skill acquisition programs overall and offer a smaller amount to external hires relative to employees with greater tenure in the organization. To be clear, this implication was not explicitly tested in the current model and is an extrapolation based on the simulation results. What was found is that when external applicants are treated the same as internals after a year, then the skill acquisition programs will not offset any competency differences between groups. An implication is that if it takes longer for externals to be treated as internals, then competency differences could be offset. This is an area for future exploration and has theoretical implications for any groups with differences in competency levels.

Limitations

As with any study, the current investigation had several limitations which could be address in future research. First, given the lack of empirical data, the results of the computational

model are theoretical and should be further validated with real-world data. However, computational results can prove to be useful provided that the assumptions underlying the theory are appropriate (Kozlowski & Chao, 2018). In the current case, the assumptions underlying the presented computational model are drawn from existing literature and robustness checks assessed the outcomes of the computational model when the assumptions were considered to have literature support. Therefore, the provided results can be useful for understanding optimal hiring decisions over time when the goal is maximizing organizational competency levels.

A more potentially impactful limitation is that the organizational sizes in the current study are somewhat small ($N < 1000$). Given that the variability in the size of organizational structures in this study ($400 \leq N \leq 825$) did not yield many meaningful differences in the pattern of results, it is likely that the results can generalize to slightly larger organizational structures – provided that the underlying processes are consistent. Nevertheless, organizational size was not systematically varied so it is difficult to determine whether the results provided in this study will generalize to much larger organizations. It may be that the inferences yielded in this study are specifically applicable to small to medium size organizations.

Similarly, the model was limited to the scope of external hires as lateral movers and internal hires as upward movers. Although, there are instances wherein external hires move upward, Bidwell and Mollick (2015) found that 87% external hires tended to move laterally into job positions with similar functions. Although these authors used a specific sample (MBA alumni), DeVaro et al. (2019) were able to recreate these results in a large-scale sample of multiple Finnish organizations, finding that lateral moves accounted for the majority of all external hiring types. Additionally, the focus of the model was on promotions through internal

hiring; however, future research could also explore staffing under conditions of internal transfers and talent shares (Sonnenfeld & Peiperl, 1988).

Finally, there were some limitations in the structuring of the organizations. Specifically, every individual had a supervisor where possible and there were no matrixed supervisors or skip-level supervisors (Ford & Randolph, 1992). In real organizations, there can also exist informal supervisor-subordinate relationships that do not appear on a formal organizational chart (Soda & Zaheer, 2012). Including these informal role relationships can be useful for better modeling how supervisors leverage subordinates' competencies. However, such informal role hierarchies are likely organization-specific and therefore difficult to parameterize in a more general model. In this manner, the presented computational model and the provided results can serve as fertile ground for future researchers to explore important staffing issues.

Future Directions

The provided computational model presents a foundational operating model for future research to utilize when assessing the optimality of hiring decisions over time and across job levels. The utility of my computational model lies in its flexibility for researchers to change the underlying processes to the specifications of their research question. Given that it is a multi-level model that tracks the impact of individual-level processes (e.g., turnover, selection, training) on organizational-level outcomes (e.g., overall competency levels), researchers can use this model to pursue a number of investigations that seek to understand the bottom-up effects of individual-level decisions/initiatives. Table 12 provides a set of selected research questions based on the discussion below. Hopefully this model can help organizational researchers continue to bridge the divide between micro- and macro-organizational research and provide more comprehensive guidance for practitioners and organizations.

One area of future investigations could focus on additional outcomes outside of organizational competency levels. Although organizations usually want maximize quality of hire, many organizations reward recruiters for focusing on speed of hire (i.e., time to replace an open position) (Ployhart & Hale, 2014). In many instances, this can create conflicting priorities for recruiters who seek to select candidates as fast as possible instead of necessarily maximizing the competency levels of out of an applicant pool. Therefore, one research question could focus on the relative tradeoffs associated with hiring out of a given labor pool when there are significant differences in speed of hire between internal and external applicants. This could also be augmented by examining cost of hire. For instance, the results of the current investigation suggest that a preference for external hires will generally yield greater results than a preference towards internal hires over time. However, external hires tend to demand higher salaries than internal applicants (Bidwell, 2011), and these salaries can compound over time due to raises, 401k plans, and other benefits. Therefore, maximizing cost and competency levels may require a different strategy. Such an examination could also include cost of turnover given that there are monetary costs associated with losing an employee (Ableson & Baysinger, 1984). In some cases, organizations may wish to examine retention rates as an outcome of a hiring strategy and the net cost incurred based on cost of hire, cost of turnover, and productivity gains of a hire. As studies begin to assess multiple outcomes associated with hiring strategies, organizational science can begin to provide a more comprehensive picture of staffing strategies over time.

Additionally, contextual factors could prove an interesting area for future study. The provided model could serve as a vehicle to study micro-macro relationships by incorporating the impact of market conditions on labor pool availability. Specifically, there can be external conditions resulting in tight/slack labor markets at different points in time for different job levels

(e.g., COVID-19; Domash & Summers, 2022). This can affect the availability of labor pools at different points in time and potentially provide more nuanced information regarding the optimality of different hiring strategies. Similarly, organizational context can also affect labor pool availability and the use of internal/external labor markets (Ferris et al., 1992). For instance, if an organization operates in a relatively niche industry, external applicants may not exist for long periods of time and so internal development may need to be prioritized. Relatedly, an organization may operate in a more general industry but operate with high baseline turnover rates, resulting in a need to hire exclusively from an external candidate pool. The described market factors on labor pool availability can result in a glut of over- or under-qualified applicants across labor pools, which may affect the type of hiring strategy that organizations ought to pursue.

Finally, researchers could examine several questions at the individual- and team-level that could impact the choice of hiring strategies. From a multi-level perspective, it might be useful to distinguish between questions that concern the composition versus the compilation of an organization. In the current study, managerial and non-managerial competencies held the same distributional properties. However, it may be the case that some non-managerial competencies (e.g., technical skills) are not distributed in the same way, which could affect outcomes. Moreover, it may be that these distributions are not the same for specific demographic groups resulting in over- or underrepresentation of these demographic groups when organizations select from the extreme ends of a given distribution. Although the current study was not focused on diversity as an outcome, organizations are increasingly concerned with adequate representation across demographic and functional backgrounds (Roberson, 2019; Bunderson & Sutcliffe, 2002). Understanding the distribution of skills across these groups and

their intersections could provide unique insight into the hiring strategies organizations should take. Similarly, the attraction-selection-attrition process may result in individuals with specific personality and vocational interests dominating an organization based on the organizational context (e.g., Ployhart et al., 2006). It would be useful to understand how these personality and interest profiles play a role in hiring strategies, particularly if these individual differences also result in unequal skills distributions for managerial and non-managerial competencies.

Compilation-based research questions might instead focus on the configural properties of an organization. Although the current study considered the overall structure of the organization, person to person and person to task relationships may result in different configurations of individuals within certain areas of the organization that are not homologous to the overall hierarchy (Lazega & Pattison, 1999). Similarly, such investigations might identify the roles which are most impactful for task completion, based on the structure of person and task networks (Oh et al., 2006). This might result in the need for differentiated hiring strategies across substructures and functional roles rather than job levels. Relatedly, organizations may restructure certain parts of the company, while leaving others the same over time, resulting in substructure transitions over time (Bowman & Singh, 1993). Although the pattern of results in the current study was relatively consistent between structural conditions, these results could potentially change when a structure shifts from one type to another.

One challenge with addressing any of these research questions in a computational setting is a lack of available representative descriptive data for parameterizing more complex models. For any simulation set-up, adequate descriptive research is required to establish appropriate parameterization of the underlying simulation processes and/or the level of process manipulation (Kozlowski, 2015; Braun et al., 2022). Therefore, as organizational begins to leverage simulated

models and computational methods for studying complex dynamics and multilevel processes that are difficult to capture in traditional observational designs, large-scale descriptive research will become increasingly valuable for scoping and parameterizing models. This, in turn, will provide more precise and accurate theory building for empirical research to test.

Table 12. Example research questions for future investigations.

Additional Outcomes
1. How does hiring externally vs internally affect time to fill?
2. How does hiring externally vs internally affect retention rates?
3. How does hiring externally vs internally affect cost of hire?
Organizational Context
4. How does market factors creating tight/slack labor markets at different points affect feasibility of selecting from different labor pools?
5. How does the niche/general nature of an industry in which an organization is situated affect hiring strategy effectiveness?
6. How does the level of under- or over-qualification in selection processes affect the quality of external/internal hires and overall hiring strategy effectiveness?
Organizational Composition and Compilation
7. What is the optimal hiring strategy when manager and tech skills are unevenly distributed in the population?
8. What is the optimal hiring strategy when manager and tech skills are unevenly distributed among different demographic groups?
9. What is the optimal hiring strategy when applicants self-select into the organization based on traits correlated with specific skillsets?
10. How does the structure of person to person and person to task relationships affect who can leverage firm-specific/generic competencies the most?
11. What role(s) in the organization are most important when structures are nested within each other?
12. How does restructuring at different points in time (i.e., transitions from one structure to another) affect the optimality of a hiring strategy?

Conclusion

Organizations are often faced with choosing between internal and external applicants when backfilling open positions. To assess which choice yields greater organizational competency levels, a computational model was developed based on prior research. Simulations were performed to understand the hiring conditions yielding optimal outcomes across a range of different contexts. Results suggested that despite the initial advantage that internal hires offer, over time, a preference towards external hires tends to yield higher levels of organizational competency levels. However, this finding was dependent on the concentration of employees located at the job level in which the hiring strategy occurs. Areas of the organization accounting for larger proportions of employee headcount demonstrated more positive effects of external hiring preferences. Notably, investment in skill acquisition programs for internal employees only served to strengthen the benefits of external hires. In general, these results can be attributed to external employees becoming internal employees over time, conferring the benefits of an internal hire while also providing the benefits of an external hire. Together, the results highlight the importance of taking time into consideration when designing organizational strategies. The computational model itself also provides fertile ground for further research on effective hiring strategies.

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APPENDIX

This appendix contains the results of the robustness checks on Assumptions 2, 3, and 7. As described in the main text, the simulation was run without including these assumptions in the model specification. To keep the simulation tractable, a truncated set of conditions was examined with internal hiring preferences ranging from .1 to .9 in increments of .2, resulting in 5 internal hiring preference conditions. Two skill acquisition investment conditions were examined (high/low). The number of timepoints, job levels and organizational structures was the same. This resulted in a 5^3x2x6x5 design and 7500 observations for each of the robustness checks.

Table A1. Robustness checks on Assumption 2: Effect of average internal hiring preference and time on organizational competency levels.

	Model 1			Model 1A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	3854.15	795.44	0.01	3347.81	795.84	0.01
Average HP	-166.09	25.68	<.001	846.59	57.10	<.001
Time	325.97	2.46	<.001	470.63	7.71	<.001
Average HP x Time				-289.34	14.66	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 1	5	109767	109802			
Model 1A	6	109390	109431	379.77	1	<.001

Note: Average HP = average internal hiring preference.

Table A2. Robustness checks on Assumption 2: Simple slopes analysis of average hiring preference by time interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Time = 1	557.25	44.39	<.001
Time = 5	-600.10	33.33	<.001

Table A3. Robustness checks on Assumption 2: Effects of hiring preference by job level and time on organizational competency levels.

	Model 2			Model 2A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	3854.15	795.44	0.01	3347.81	795.85	0.014
HP1	-69.21	14.81	<.001	224.38	32.91	<.001
HP2	-4.91	14.81	0.74	470.63	7.70	<.001
HP3	-91.98	14.81	<.001	302.57	32.91	<.001
Time	325.97	2.45	<.001	319.64	32.91	<.001
HP1 x Time				-83.88	8.45	<.001
HP2 x Time				-87.85	8.45	<.001
HP3 x Time				-117.61	8.45	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 2	7	109753	109801			
Model 2A	10	109369	109438	390.25	3	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A4. Robustness checks on Assumption 2: Simple slopes analysis of hiring preference by time interaction on organizational competency levels across job levels.

		Test Estimate	Std. Error	p
Job Level 1	Time = 1	140.50	117.99	0.230
	Time = 5	-195.03	88.58	0.030
Job Level 2	Time = 1	214.72	117.99	0.070
	Time = 5	-136.68	88.58	0.120
Job Level 3	Time = 1	202.03	117.99	0.090
	Time = 5	-268.39	88.58	0.002

Table A5. Robustness checks on Assumption 2: Wald tests of coefficient equality for hiring preference and hiring preference by time interactions.

Model 2				Model 2A			
Contrast	Difference	SE	p	Contrast	Difference	SE	p
HP1 vs HP2	-0.11	0.04	<.001	HP1 x Time vs HP2 x Time	3.97	55.11	0.94
HP1 vs HP3	0.02	0.04	0.65	HP1 x Time vs HP3 x Time	33.73	55.11	0.54
HP2 vs HP3	0.13	0.04	<.001	HP2 x Time vs HP3 x Time	29.76	55.11	0.59

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A6. Robustness checks on Assumption 2: Effects of hiring preference, time, and headcount proportion across job levels on average organizational competency levels.

	Model 2B			Model 2C			Model 2D		
	Estimate	Std. Error	p	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	7.06	0.03	<.001	5.19	0.72	<.001	8.72	1.57	<.001
HP1	-0.14	0.03	<.001	-0.01	0.05	0.883	0.28	0.11	0.009
HP2	-0.03	0.03	0.310	0.18	0.07	0.006	0.46	0.14	0.001
HP3	-0.16	0.03	<.001	0.09	0.07	0.204	-0.02	0.15	0.906
Time	0.60	0.00	<.001	0.60	0.00	<.001	-0.41	0.40	0.306
PROP HC L1				-0.37	0.70	0.604	-4.70	1.53	0.002
PROP HC L2				2.69	0.77	<.001	-1.46	1.67	0.384
PROP HC L3				5.30	1.41	<.001	-4.03	3.07	0.189
HP1 x PROP HC L1				-0.50	0.16	0.002	0.59	0.36	0.094
HP2 x PROP HC L2				-0.85	0.25	0.001	0.41	0.55	0.449
HP3 x PROP HC L3				-1.01	0.27	<.001	2.38	0.59	<.001
PROP HC L1 x Time							1.24	0.39	0.002
PROP HC L2 x Time							1.18	0.43	0.006
PROP HC L3 x Time							2.67	0.79	0.001
HP1 x Time							-0.08	0.03	0.003
HP2 x Time							-0.08	0.04	0.026
HP3 x Time							0.03	0.04	0.435
HP1 x PROP HC L1 x Time							-0.31	0.09	0.001

Table A6 (cont'd).

HP2 x PROP HC L2 x Time			-0.36	0.14	0.010
HP3 x PROP HC L3 x Time			-0.97	0.15	<.001

Model Fit Statistics	df	F	p
MODEL 2B			
MODEL 2C	6	714.28	<.001
MODEL 2C			
MODEL 2D	9	82.63	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3. PROP HC L1 = proportion of headcount at job level 1. PROP HC L2 = proportion of headcount at job level 2. PROP HC L3 = proportion of headcount at job level 3.

Table A7. Robustness check on Assumption 2: Simple slopes analysis of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.

			Test Estimate	Std. Error	p
Job Level 1	Time = 1	PROP HC = Low	0.22	0.06	<.001
	Time = 1	PROP HC = High	0.24	0.07	<.001
	Time = 5	PROP HC = Low	-0.22	0.05	<.001
	Time = 5	PROP HC = High	-0.62	0.05	<.001
Job Level 2	Time = 1	PROP HC = Low	0.39	0.06	<.001
	Time = 1	PROP HC = High	0.40	0.08	<.001
	Time = 5	PROP HC = Low	-0.14	0.04	<.001
	Time = 5	PROP HC = High	-0.49	0.06	<.001
Job Level 3	Time = 1	PROP HC = Low	0.19	0.07	<.001
	Time = 1	PROP HC = High	0.53	0.07	<.001
	Time = 5	PROP HC = Low	-0.17	0.05	<.001
	Time = 5	PROP HC = High	-0.76	0.05	<.001

Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level.

Table A8. Robustness check on Assumption 2: Effects of average internal hiring preference and investment in skill acquisition on organizational competency levels.

	Model 3			Model 3A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	3643.51	795.41	0.010	3574.02	795.48	0.011
Average HP	-166.09	20.92	<.001	-27.12	29.50	0.358
SK ACQ	561.71	9.11	<.001	747.02	29.26	<.001
Time	325.97	2.00	<.001	325.97	1.99	<.001
Average HP x SK ACQ				-370.61	55.62	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 3	6	106693	106734			
Model 3A	7	106650	106699	44.291	1	<.001

Note: Average HP = average internal hiring preference. SK ACQ = level of investment in skill acquisition programs.

Table A9. Robustness check on Assumption 2: Simple slopes analysis of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Low Investment	-27.12	29.50	0.36
High Investment	-305.07	29.50	<.001

Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Table A10. Robustness checks on Assumption 3: Effect of average internal hiring preference and time on organizational competency levels.

	Model 1			Model 1A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	1136.16	209.84	0.006	1027.78	210.45	0.008
Average HP	-57.38	15.63	<.001	159.38	35.53	<.001
Time	113.78	1.49	<.001	144.75	4.80	<.001
Average HP x Time				-61.93	9.12	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 1	5	102306	102341			
Model 1A	6	102263	102304	45.97	1	<.001

Note: Average HP = average internal hiring preference.

Table A11. Robustness checks on Assumption 3: Simple slopes analysis of average hiring preference by time interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Time = 1	97.45	27.62	<.001
Time = 5	-150.28	20.74	<.001

Table A12. Robustness checks on Assumption 3: Effects of hiring preference by job level and time on organizational competency levels.

	Model 2			Model 2A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	1136.16	209.84	0.006	1027.78	210.45	0.008
HP1	-12.02	9.02	0.183	57.53	20.51	0.005
HP2	-14.31	9.02	0.113	144.75	4.80	<.001
HP3	-31.06	9.02	0.001	57.74	20.51	0.005
Time	113.78	1.49	<.001	44.11	20.51	0.032
HP1 x Time				-19.87	5.27	<.001
HP2 x Time				-20.59	5.27	<.001
HP3 x Time				-21.48	5.27	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 2	7	102308	102356			
Model 2A	10	102268	102337	46.033	3	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A13. Robustness checks on Assumption 3: Simple slopes analysis of hiring preference by time interaction on organizational competency levels across job levels.

		Test Estimate	Std. Error	p
Job Level 1	Time = 1	37.66	15.95	0.02
	Time = 5	-41.82	11.97	<.001
Job Level 2	Time = 1	37.16	15.95	0.02
	Time = 5	-45.18	11.97	<.001
Job Level 3	Time = 1	22.64	15.95	0.16
	Time = 5	-63.27	11.97	<.001

Table A14. Robustness checks on Assumption 3: Wald tests of coefficient equality for hiring preference and hiring preference by time interactions.

Model 2				Model 2A			
Contrast	Difference	SE	p	Contrast	Difference	SE	p
HP1 vs HP2	0.01	0.02	0.75	HP1 x Time vs HP2 x Time	0.72	16.02	0.96
HP1 vs HP3	0.03	0.02	0.19	HP1 x Time vs HP3 x Time	1.61	16.02	0.92
HP2 vs HP3	0.02	0.02	0.32	HP2 x Time vs HP3 x Time	0.89	16.02	0.96

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A15. Robustness checks on Assumption 3: Effects of hiring preference, time, and headcount proportion across job levels on average organizational competency levels.

	Model 2B			Model 2C			Model 2D		
	Estimate	Std. Error	p	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	2.10	0.02	0.000	1.81	0.50	0.000	2.27	1.14	0.048
HP1	-0.02	0.02	0.128	0.01	0.03	0.662	0.06	0.08	0.409
HP2	-0.03	0.02	0.048	0.03	0.05	0.564	0.09	0.10	0.377
HP3	-0.05	0.02	0.001	0.01	0.05	0.763	-0.03	0.11	0.802
Time	0.21	0.00	<.001	0.21	0.00	<.001	-0.14	1.12	0.897
PROP HC L1				0.83	0.49	0.093	-0.08	1.22	0.947
PROP HC L2				0.39	0.54	0.468	-1.26	2.24	0.574
PROP HC L3				-0.10	0.99	0.919	0.08	0.29	0.790
HP1 x PROP HC L1				-0.15	0.11	0.195	0.18	0.26	0.499
HP2 x PROP HC L2				-0.24	0.18	0.175	0.06	0.40	0.873
HP3 x PROP HC L3				-0.28	0.19	0.137	0.43	0.43	0.320
PROP HC L1 x Time							0.28	0.29	0.333
PROP HC L2 x Time							0.13	0.31	0.667
PROP HC L3 x Time							0.33	0.57	0.565
HP1 x Time							-0.01	0.02	0.481
HP2 x Time							-0.02	0.03	0.484
HP3 x Time							0.01	0.03	0.669
HP1 x PROP HC L1 x Time							-0.09	0.07	0.165

Table A15 (cont'd).

HP2 x PROP HC L2 x Time			-0.09	0.10	0.399
HP3 x PROP HC L3 x Time			-0.20	0.11	0.066

Model Fit Statistics	df	F	p
MODEL 2B			
MODEL 2C	6	132.34	<.001
MODEL 2C			
MODEL 2D	9	11.41	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3. PROP HC L1 = proportion of headcount at job level 1. PROP HC L2 = proportion of headcount at job level 2. PROP HC L3 = proportion of headcount at job level 3.

Table A16. Robustness check on Assumption 3: Simple slopes analysis of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.

			Test Estimate	Std. Error	p
Job Level 1	Time = 1	PROP HC = Low	0.06	0.05	0.200
	Time = 1	PROP HC = High	0.09	0.05	0.090
	Time = 5	PROP HC = Low	-0.03	0.03	0.340
	Time = 5	PROP HC = High	-0.15	0.04	<.001
Job Level 2	Time = 1	PROP HC = Low	0.07	0.04	0.090
	Time = 1	PROP HC = High	0.06	0.06	0.250
	Time = 5	PROP HC = Low	-0.05	0.03	0.080
	Time = 5	PROP HC = High	-0.15	0.04	<.001
Job Level 3	Time = 1	PROP HC = Low	0.01	0.05	0.800
	Time = 1	PROP HC = High	0.07	0.05	0.170
	Time = 5	PROP HC = Low	-0.04	0.04	0.280
	Time = 5	PROP HC = High	-0.18	0.04	<.001

Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level.

Table A17. Robustness check on Assumption 3: Effects of average internal hiring preference and investment in skill acquisition on organizational competency levels.

	Model 3			Model 3A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	947.70	209.70	0.011	931.53	209.74	0.011
Average HP	-57.38	8.15	<.001	-25.05	11.51	0.030
SK ACQ	502.57	3.55	<.001	545.67	11.42	<.001
Time	113.78	0.78	<.001	113.78	0.78	<.001
Average HP x SK ACQ				-86.21	21.71	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 3	6	92551	92592			
Model 3A	7	92537	92585	15.757	1	<.001

Note: Average HP = average internal hiring preference. SK ACQ = level of investment in skill acquisition programs.

Table A18. Robustness check on Assumption 3: Simple slopes analysis of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Low Investment	-25.05	11.51	0.03
High Investment	-89.71	11.51	<.001

Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Table A19. Robustness checks on Assumption 7: Effect of average internal hiring preference and time on organizational competency levels.

	Model 1			Model 1A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	1600.64	314.82	0.01	1400.59	315.75	0.011
Average HP	25.61	23.76	0.28	425.70	53.94	<.001
Time	138.50	2.27	<.001	195.66	7.29	<.001
Average HP x Time				-114.31	13.85	<.001
Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 1	5	108592	108626			
Model 1A	6	108526	108568	67.84	1	<.001

Note: Average HP = average internal hiring preference.

Table A20. Robustness checks on Assumption 7: Simple slopes analysis of average hiring preference by time interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Time = 1	311.39	41.93	<.001
Time = 5	-145.86	31.48	<.001

Table A21. Robustness checks on Assumption 7: Effects of hiring preference by job level and time on organizational competency levels.

	Model 2			Model 2A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	1600.64	314.82	0.01	1400.59	315.75	0.011
HP1	2.33	13.71	0.86	125.05	31.13	<.001
HP2	37.41	13.71	0.01	195.66	7.28	<.001
HP3	-14.14	13.71	0.30	139.30	31.13	<.001
Time	138.50	2.27	<.001	161.36	31.13	<.001
HP1 x Time				-35.06	7.99	<.001
HP2 x Time				-29.11	7.99	<.001
HP3 x Time				-50.14	7.99	<.001

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 2	7	108588	108637			
Model 2A	10	108523	108592	71.59	3	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A22. Robustness checks on Assumption 7: Simple slopes analysis of hiring preference by time interaction on organizational competency levels across job levels.

		Test Estimate	Std. Error	p
Job Level 1	Time = 1	89.99	24.20	<.001
	Time = 5	-50.26	18.17	0.006
Job Level 2	Time = 1	110.19	24.20	<.001
	Time = 5	-6.26	18.17	0.731
Job Level 3	Time = 1	111.22	24.20	<.001
	Time = 5	-89.35	18.17	<.001

Table A23. Robustness checks on Assumption 7: Wald tests of coefficient equality for hiring preference and hiring preference by time interactions.

Model 2				Model 2A			
Contrast	Difference	SE	p	Contrast	Difference	SE	p
HP1 vs HP2	-0.06	0.03	0.07	HP1 x Time vs HP2 x Time	-5.95	24.09	0.80
HP1 vs HP3	0.03	0.03	0.44	HP1 x Time vs HP3 x Time	15.08	24.09	0.53
HP2 vs HP3	0.08	0.03	0.01	HP2 x Time vs HP3 x Time	21.03	24.09	0.38

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3.

Table A24. Robustness checks on Assumption 7: Effects of hiring preference, time, and headcount proportion across job levels on average organizational competency levels.

	Model 2B			Model 2C			Model 2D		
	Estimate	Std. Error	p	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	2.95	0.03	<.001	2.29	0.76	0.003	3.46	1.72	0.045
HP1	0.00	0.02	0.924	0.05	0.05	0.330	0.22	0.12	0.057
HP2	0.06	0.02	0.009	0.12	0.07	0.076	0.36	0.16	0.023
HP3	-0.02	0.02	0.320	-0.01	0.07	0.894	-0.06	0.17	0.742
Time	0.25	0.00	<.001	0.25	0.00	0.000	-0.08	0.44	0.856
PROP HC L1				0.18	0.74	0.814	-1.37	1.69	0.416
PROP HC L2				1.31	0.81	0.106	0.11	1.84	0.954
PROP HC L3				1.17	1.49	0.432	-2.16	3.38	0.523
HP1 x PROP HC L1				-0.18	0.17	0.297	0.09	0.39	0.822
HP2 x PROP HC L2				-0.25	0.26	0.349	-0.46	0.60	0.439
HP3 x PROP HC L3				-0.05	0.29	0.849	1.34	0.65	0.038
PROP HC L1 x Time							0.44	0.43	0.307
PROP HC L2 x Time							0.34	0.47	0.466
PROP HC L3 x Time							0.95	0.87	0.273
HP1 x Time							-0.05	0.03	0.101
HP2 x Time							-0.07	0.04	0.096
HP3 x Time							0.01	0.04	0.763
HP1 x PROP HC L1 x Time							-0.08	0.10	0.447

Table A24 (cont'd).

HP2 x PROP HC L2 x Time			0.06	0.15	0.688
HP3 x PROP HC L3 x Time			-0.40	0.17	0.016

Model Fit Statistics	df	F	p
MODEL 2B			
MODEL 2C	6	27.04	<.001
MODEL 2C			
MODEL 2D	9	9.98	<.001

Note: HP1 = internal hiring preference at job level 1. HP2 = internal hiring preference at job level 2. HP3 = internal hiring preference at job level 3. PROP HC L1 = proportion of headcount at job level 1. PROP HC L2 = proportion of headcount at job level 2. PROP HC L3 = proportion of headcount at job level 3.

Table A25. Robustness check on Assumption 7: Simple slopes analysis of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.

			Test Estimate	Std. Error	p
Job Level 1	Time = 1	PROP HC = Low	0.17	0.07	0.010
	Time = 1	PROP HC = High	0.18	0.08	0.030
	Time = 5	PROP HC = Low	-0.05	0.05	0.320
	Time = 5	PROP HC = High	-0.17	0.06	0.010
Job Level 2	Time = 1	PROP HC = Low	0.23	0.07	<.001
	Time = 1	PROP HC = High	0.13	0.08	0.122
	Time = 5	PROP HC = Low	0.00	0.05	0.990
	Time = 5	PROP HC = High	-0.04	0.06	0.520
Job Level 3	Time = 1	PROP HC = Low	0.08	0.07	0.310
	Time = 1	PROP HC = High	0.3	0.07	<.001
	Time = 5	PROP HC = Low	-0.07	0.06	0.190
	Time = 5	PROP HC = High	-0.22	0.05	<.001

Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level.

Table A26. Robustness check on Assumption 7: Effects of average internal hiring preference and investment in skill acquisition on organizational competency levels.

	Model 3			Model 3A		
	Estimate	Std. Error	p	Estimate	Std. Error	p
Intercept	1332.35	314.62	0.013	1324.08	314.70	0.014
Average HP	25.61	14.29	0.073	42.15	20.21	0.037
SK ACQ	715.44	6.22	<.001	737.50	20.05	<.001
Time	138.50	1.37	<.001	138.50	1.37	<.001
Average HP x SK ACQ				-44.11	38.11	0.247

Model Fit Statistics	npar	AIC	BIC	Chisq	df	p
Model 3	6	100975	101016			
Model 3A	7	100976	101024	1.3398	1	0.247

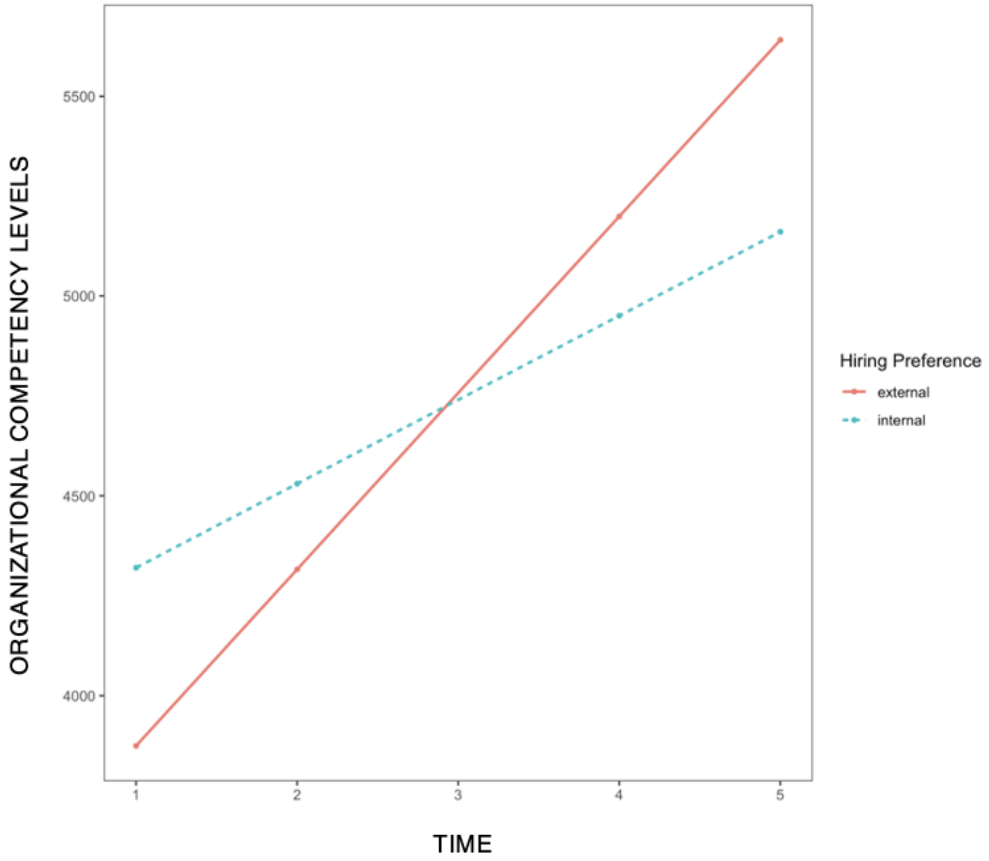
Note: Average HP = average internal hiring preference. SK ACQ = level of investment in skill acquisition programs.

Table A27. Robustness check on Assumption 7: Simple slopes analysis of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.

	Test Estimate	Std. Error	p
Low Investment	42.15	20.21	0.037
High Investment	9.07	20.21	0.653

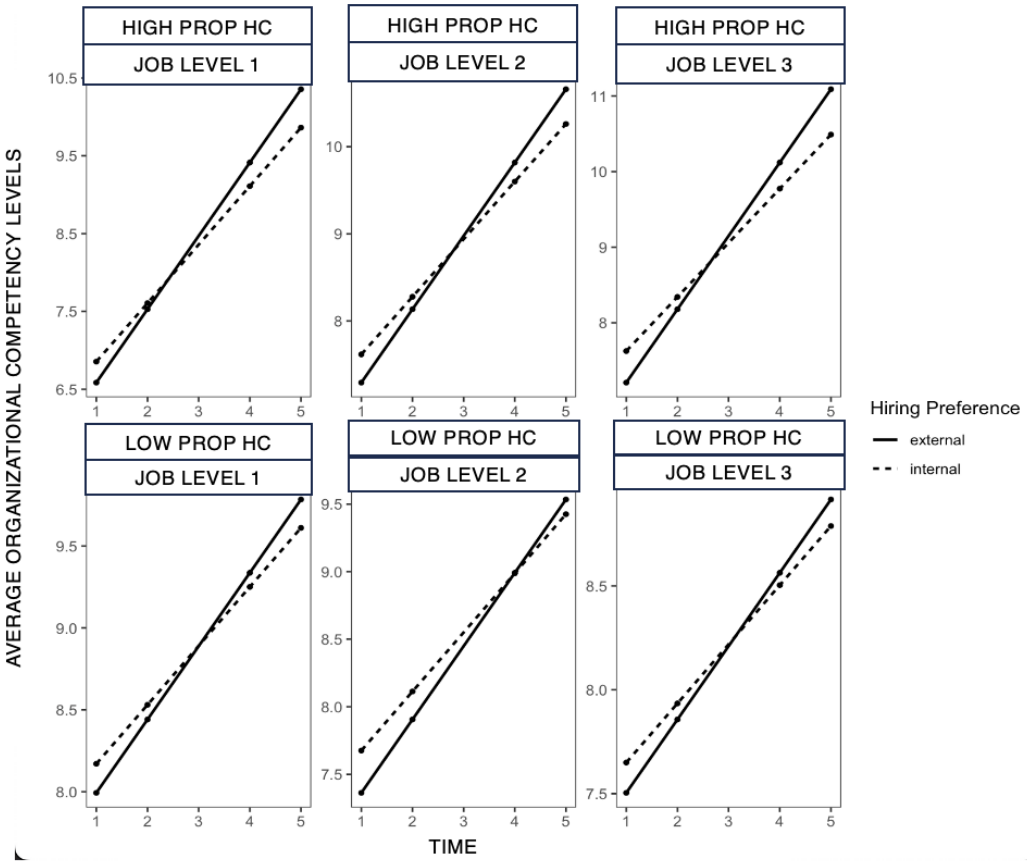
Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Figure A1. Robustness Check on Assumption 2: Simple slopes plot of average hiring preference by time interaction on organizational competency levels.



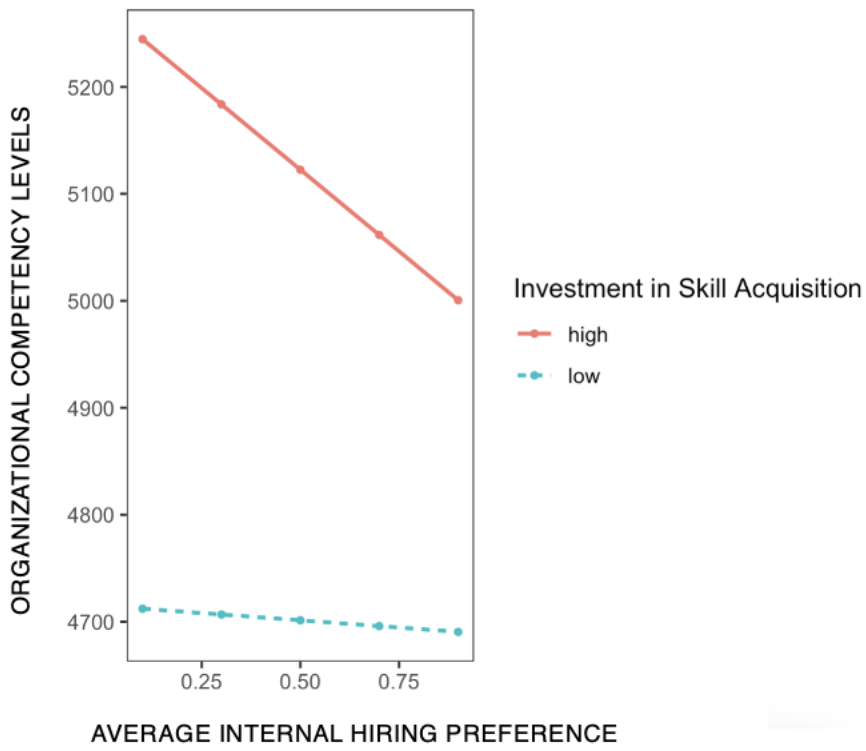
Note: External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A2. Robustness Check on Assumption 2: Simple slopes plot of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.



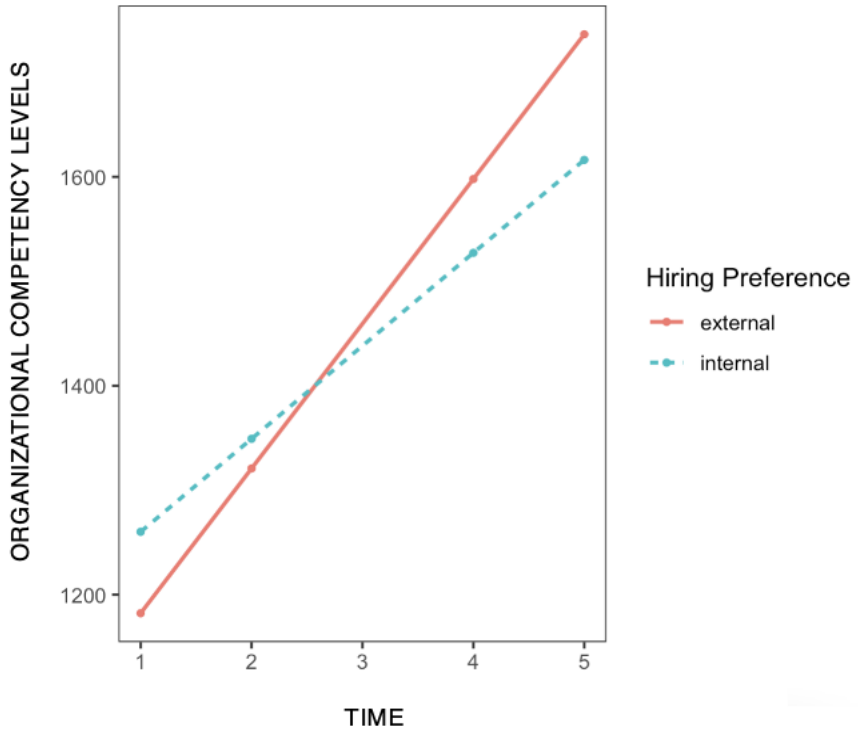
Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level. External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A3. Robustness Check on Assumption 2: Simple slopes plot of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.



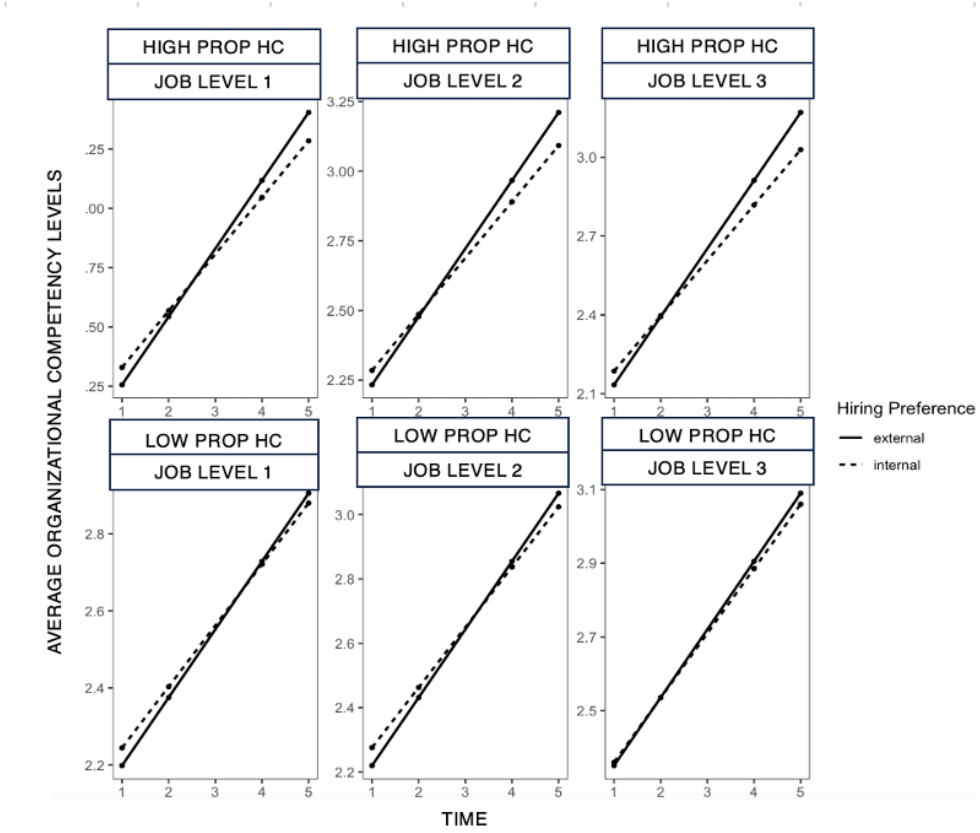
Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Figure A4. Robustness Check on Assumption 3: Simple slopes plot of average hiring preference by time interaction on organizational competency levels.



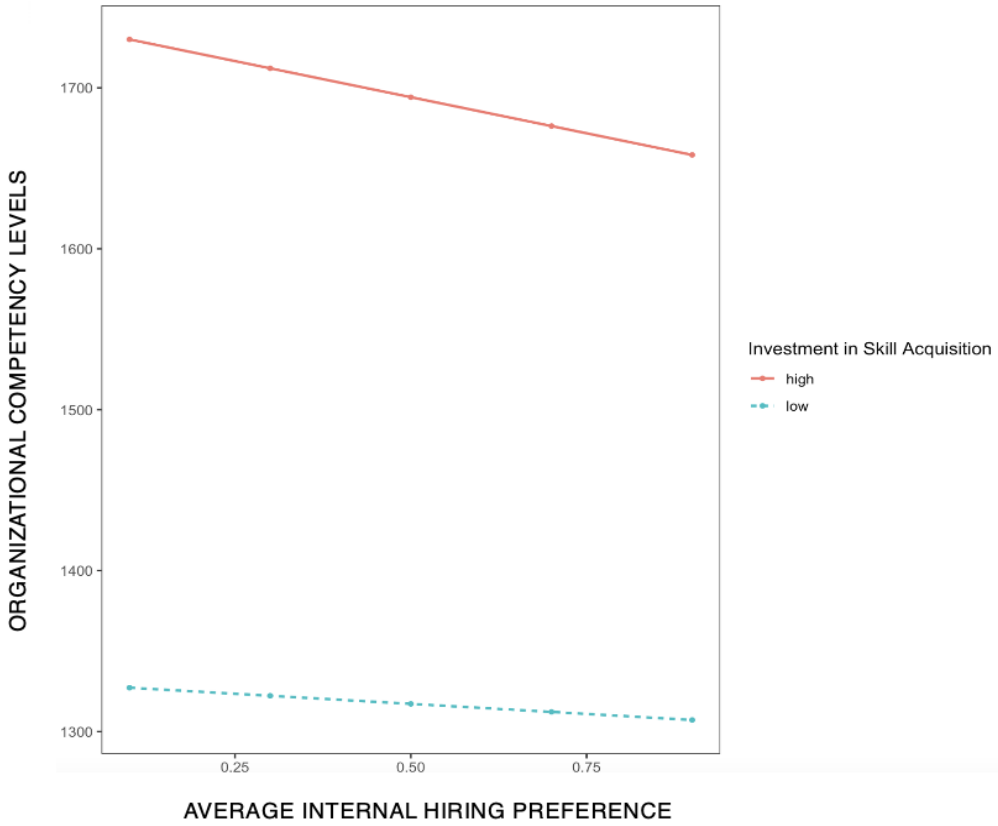
Note: External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A5. Robustness Check on Assumption 3: Simple slopes plot of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.



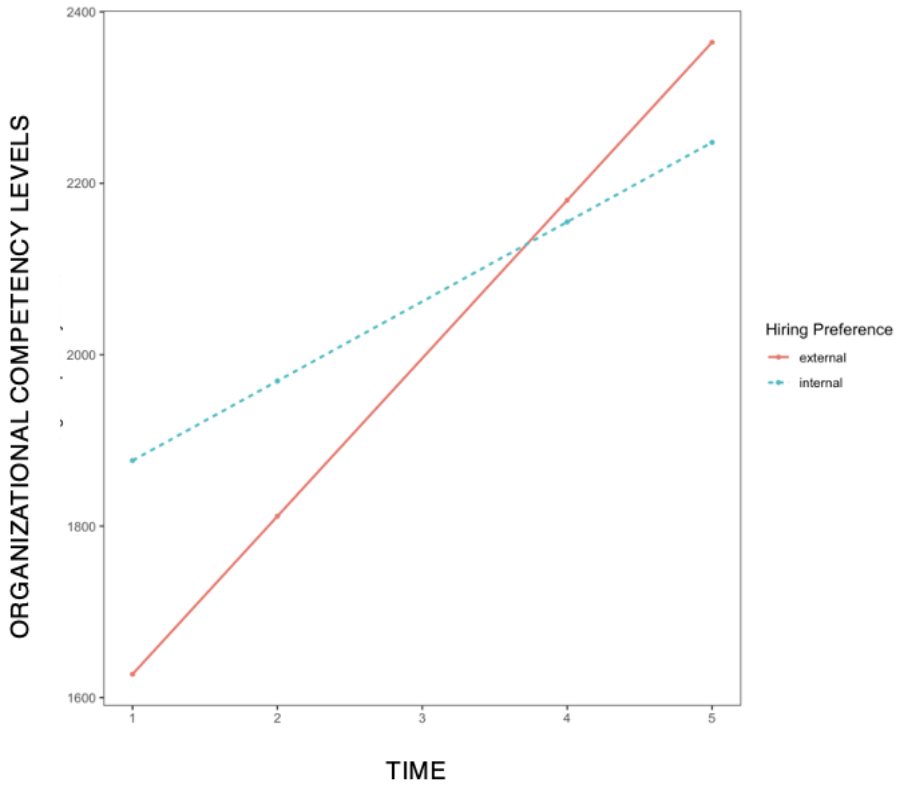
Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level. External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A6. Robustness Check on Assumption 3: Simple slopes plot of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.



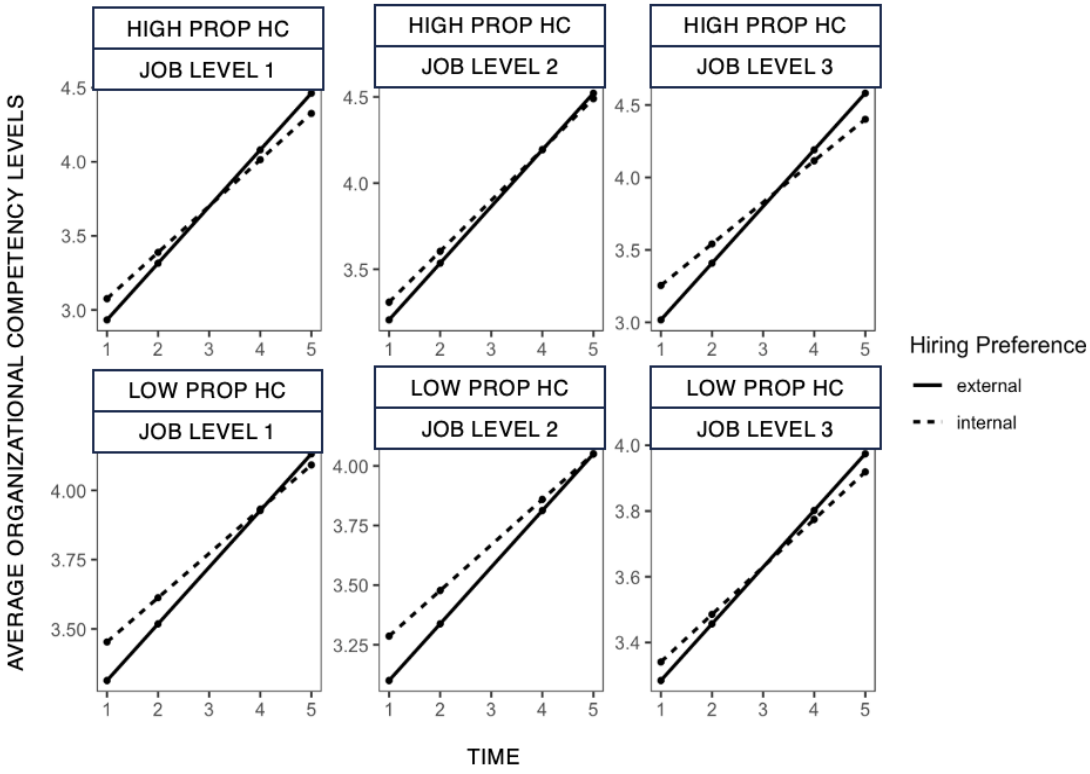
Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.

Figure A7. Robustness Check on Assumption 7: Simple slopes plot of average hiring preference by time interaction on organizational competency levels.



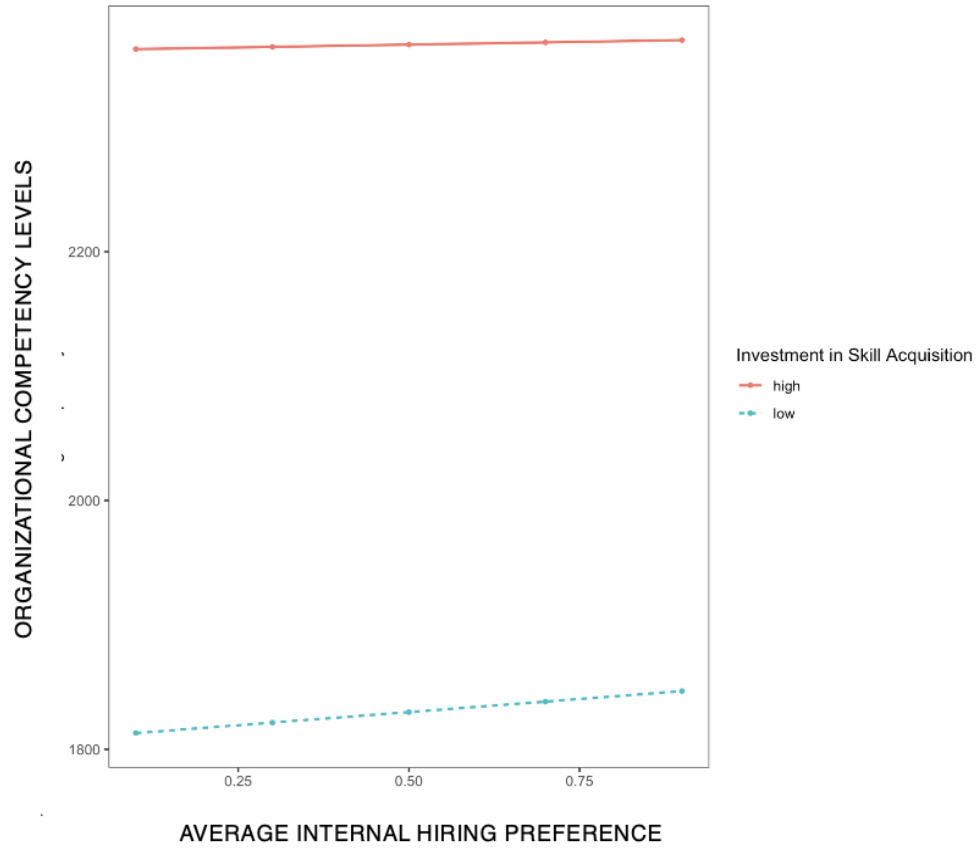
Note: External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A8. Robustness Check on Assumption 7: Simple slopes plot of hiring preference by time by headcount proportion interaction across job levels on average organizational competency levels.



Note: PROP HC = proportion of headcount at a given level. Low PROP HC = minimum headcount proportion for a given level. High PROP HC = maximum headcount proportion for a given level. External hiring preference = 10% preference for internal hires. Internal hiring preference = 90% preference for internal hires.

Figure A9. Robustness Check on Assumption 7: Simple slopes plot of average internal hiring preference by skill acquisition investment interaction on organizational competency levels.



Note: Low investment in skill acquisition condition = 0% investment. High investment in skill acquisition condition = 75%.