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THE DYNAMIC NATURE OF COLLECTIVE TURNOVER AND UNIT PERFORMANCE: THE IMPACT OF TIME, QUALITY, AND REPLACEMENTS

MATTHEW L. CALL
ANTHONY J. NYBERG
ROBERT E. PLOYHART
University of South Carolina

JEFF WEEKLEY
IBM

This study builds from context-emergent turnover theory to examine the dynamic properties of turnover rates, including: (a) the changing quality and quantity of the human capital resources that depart, (b) the changing turnover dispersion (i.e., how distributed turnover events are over time), and (c) the changing quality and quantity of replacement hires. We examine these properties using data drawn from a sample of retail employees nested within stores of a prominent U.S. retail chain over five quarters, and show that the turnover rate (level) is conceptually and empirically distinct from turnover rate change, and that the two interact with each other to influence changes in unit performance. We also find that the relationship between turnover rate change and change in unit performance is moderated by both the quality of those who leave as well as turnover dispersion. Overall, we contribute to turnover rate, staffing, and human capital resource literatures by testing core context-emergent turnover theory propositions to show when, why, and how turnover rate change and replacement hires, as part of a holistic human capital resource system, influence unit performance.

Collective turnover is a phenomenon of considerable practical importance and scholarly interest. Three recent meta-analyses (Hancock, Allen, Bosco, McDaniel, & Pierce, 2013; Heavey, Holwerda, & Hausknecht, 2013; Park & Shaw, 2013) reported a negative turnover rate–unit performance relationship. While this research has provided many insights, most of the primary studies examine static turnover rates, treat each employee departure identically, and ignore replacements. Examining turnover in isolation is necessarily limited because real-world turnover is not isolated, but, rather, embedded within broader dynamic systems. Indeed, Price (1977: 118) postulated that, "it may be that it is not the absolute amount of turnover which is significant for effectiveness, but whether there is variability in the amount of turnover." Over 30 years later, this speculation remains largely unexamined.

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Recent theoretical advancements have begun to consider collective turnover within broader systems (Hausknecht & Holwerda, 2013; Nyberg & Ployhart, 2013; Reilly, Nyberg, Maltarich, & Weller, 2014). Context-emergent turnover (CET) theory, for instance, conceptualizes turnover within flows of human capital resources (HCR), and defines "collective turnover" as the quantity *and* quality of knowledge, skills, abilities, and other characteristics (KSAO) depleted from a unit (Nyberg & Ployhart, 2013: 112). CET theory posits that the quantity and quality of turnover rates and replacement hires interact within a dynamic temporal system to influence unit performance.

We build on CET theory to better understand the boundaries of established negative turnover rate relationships in such dynamic systems. The current manuscript addresses these issues and the dynamic relationships between turnover rates and unit performance, and consequently extends turnover research in four ways. First, we develop conceptual and empirical distinctions between *turnover rates* (i.e., the absolute level) and *turnover rate changes* (i.e., the turnover rate change over time). While we do not expect turnover rate change to contradict findings based on turnover rates, turnover rate change should provide insights about the nature and consequences of turnover beyond that which can be explained by static models (Nyberg & Ployhart, 2013). Indeed, we expect turnover rates and turnover rate changes to be distinct from, yet interactive with, each other.

Second, we test CET theory's emphasis on the joint importance of turnover rate quantity *and* quality (Nyberg & Ployhart, 2013). Most turnover rate research exclusively studies quantity (rates), and the field has only recently begun examining quantity losses over time (Reilly et al., 2014). Losing higher-quality employees is more disruptive than losing lower-quality employees (Shaw, Duffy, Johnson, & Lockhart, 2005). However, to date, no research *simultaneously* tests the flow of turnover rate quality and quantity over time as prescribed by CET theory, meaning that it is unclear how these two key elements function in the same system. Therefore, we examine how and why turnover rate quantity and quality work together over time to influence unit performance, and provide the first empirical test of this dynamic relationship.

Third, we build on Hausknecht and Holwerda's (2013) discussion about turnover event dispersion. As experienced by managers and employees, turnover events are not averages or rates, but, rather, individual events that occur over time. For example, one may expect different effects between two units that each lose 12 employees in a year—the first unit losing 1 employee per month and the second losing all 12 employees in one month. Static, annual turnover rates fail to capture what are likely large differences administratively and psychologically (Nyberg & Ployhart, 2013; Reilly et al., 2014). In the current study, we examine how *turnover dispersion*, defined as the extent to which turnover events are spread across time, influences the turnover rate change–unit performance relationship.

Fourth, we test CET theory predictions that effects due to losses (quantity or quality) may be affected by replacements (quantity or quality). HCR inflows (e.g., staffing) and outflows (e.g., turnover rates) are usually studied in isolation (Boudreau & Berger, 1985), with each research stream siloed and rarely referencing the other (Park & Shaw, 2013). This isolation is curious, given that turnover rates and staffing are inextricably interconnected. Turnover cannot occur until after hiring, and oftentimes hiring responds to turnover (Hausknecht & Trevor, 2011; Reilly, et al., 2014; Shaw, 2011). This lack of integration between turnover and staffing literatures challenges our ability to understand the HCR flow system, and risks creating theory that works in isolation but fails in a broader system. In the extreme, it could mean prescribing selection systems that (unintentionally) lead to increased turnover (Maltarich, Nyberg, & Reilly, 2010). In the current manuscript, we examine the impact that the quality and quantity of replacement hires has in moderating the turnover rate change–unit performance relationship.

Overall, we contribute to understanding the dynamic role of HCR flows, both in and out of the unit, to affect unit performance over time (Figure 1 shows this system). We first distinguish turnover rate from turnover rate change (Hypotheses 1 and 2), and then examine the dynamic nature of turnover rates (Hypotheses 3–5). We test our hypotheses within a large retail organization containing 108,357 employees nested within 988 units over five quarters. We focus on predicting unit performance over time, which is itself a contribution, because most turnover-rate research has examined static performance outcomes (Park & Shaw, 2013).

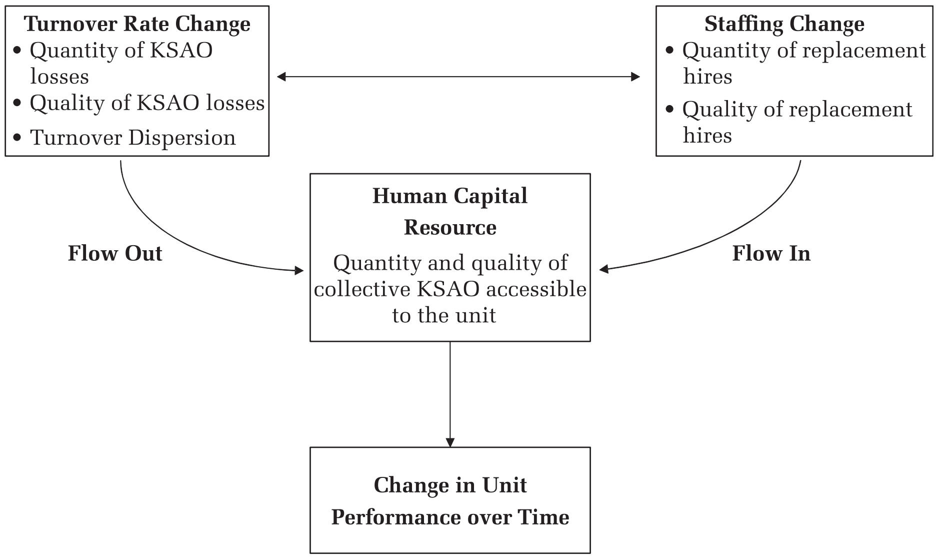
THEORY AND HYPOTHESES

This study is grounded in CET theory (Nyberg & Ployhart, 2013) which conceptualizes turnover rates as the loss of HCR within a dynamic system; turnover rates emerge from individual turnover events and aggregate to collective levels over time. CET theory proposes a distinction between the quantity and quality of turnover rates, with each having distinct effects on unit performance over time (Nyberg & Ployhart, 2013). CET theory also accounts for the quantity and quality of HCR inflows through hiring and staffing. Hence, CET theory recognizes that staffing and turnover are different sides of the same HCR flow system, with both having quantity and quality elements that may interact to influence unit performance. Time is therefore central in this system. The following sections develop these points in more detail, and extend them by incorporating new insights about turnover dispersion (Hausknecht & Holwerda, 2013).

Static and Dynamic Features of Turnover Rates

Research has found robust turnover rate effects that largely hold across different industries, contexts, and outcomes (Hancock et al., 2013; Heavey, et al., 2013; Park & Shaw, 2013). CET theory extends these cross-sectional findings by focusing on flows

FIGURE 1
HCR Flow System: Turnover Rate Change, Staffing, and Unit Performance



over time. One implication is that static turnover rates will be theoretically and empirically distinct from turnover rate changes. Differences between average levels and change have been observed in other domains (e.g., Vancouver, Thompson, & Williams, 2001), and within the context of turnover intentions at the individual level (Chen, Ployhart, Thomas, & Bliese, 2011), but have not been examined with turnover rates. Hancock et al. (2013: 599) summarized this by stating:

> Similarly, even when researchers have collected turnover data at more than one time point, they have not so far assessed the possible impact of changes in turnover rates on performance. Allen et al. (2010) suggest that the extent to which turnover rates are increasing or decreasing may be at least as important as the level of turnover in understanding the likely impact of turnover on the organization. Thus, we encourage scholars to tackle these challenging temporal issues conceptually and methodologically.

Turnover rate and turnover rate change share many similarities. Both static and dynamic rates can negatively influence unit performance through HCR depletion, hence requiring other employees to cover or fill in for vacant positions. If staffing falls below a minimum threshold, then even basic work responsibilities cannot be performed (Reilly, et al., 2014). Thus, static turnover rates and change share a common theoretical explanation. Empirically, static turnover rate measures must capture some basic elements of change because turnover rates estimate the number of turnover events *over some time period* (e.g., quarterly, annually).

However, turnover rate and turnover rate change also manifest conceptual and empirical differences. Turnover rate change evokes theoretical considerations not realized or observable in static turnover rates. First, increasing turnover rates causes problems with workloads and workflow that compound over time (Nyberg & Ployhart, 2013). For instance, employees in units with increasing turnover rates may see their workloads expand as they fill in for missing staff (Reilly et al., 2014). While high turnover rates will create staffing challenges, changes in rates are likely to create additional challenges because of the difficulty associated with planning for changes (Price, 1977). Effective staffing requires accurately forecasting hiring and replacement cycles (Boudreau & Berger, 1985; Cappelli, 2009; Cascio, 2000). For instance, if turnover rates are steady (even if high), units can create routines to replenish staff in a timely manner. Price (1977) used this logic when he posited that the predictability of even high turnover could be easier to plan for administratively than high variability in low absolute turnover rates. For example, the fast food industry has developed capabilities for dealing with chronically high turnover rates, such as compartmentalizing jobs and using technology to minimize training requirements. In contrast, when turnover rates are increasing, units can struggle to adapt to departure variations (Cappelli, 2009). Turnover rate changes can also produce increasingly greater uncertainty (Sirmon, Hitt, & Ireland, 2007; Turner, 2014). Thus, turnover rate changes act as a disruption to operational performance in a different way than does a static turnover rate.

Second, CET theory (Nyberg & Ployhart, 2013) predicts that the psychological experiences associated with working in a unit where turnover rates are changing will be different from those occurring in a unit with a static turnover rate. For example, increasing turnover rates will increase job demands for the remaining employees, who may in turn experience decreased motivation and inability to perform the same quality of work (Reilly et al., 2014). Changing turnover rates will also divert more focus and energy away from more productive workers as longer-tenured employees spend time training additional replacements (Hausknecht & Trevor, 2011; Reilly et al., 2014). Diverting attention from one's regular tasks also disrupts the communication, pacing, and coordination of the entire unit (Marks, Mathieu, & Zaccaro, 2001; Nyberg & Ployhart, 2013). Turnover rate change may also act as a shock to the remaining employees (Burke, Stagl, Salas, Pierce, & Kendall, 2006; Summers, Humphrey, & Ferris, 2012), whereas constant turnover rates may allow employees to become inured to the turnover rate environment. Increasing turnover rates will eventually erode a unit's climate and cohesion, which in turn reduces sharing, trust, and collaboration (Shaw et al., 2005). Ultimately, changing turnover rates affect the psychological nature of work and relationships because individuals interpret changes in their environment as indications of the future (Freyd & Finke, 1984). These changes can produce a contagion effect on those who remain (Felps et al., 2009). As employees notice increasing turnover, the expectation is that turnover rates will continue to increase, possibly prompting even more departures (Felps et al., 2009) as employee's links to and identification with others erodes, thus diminishing embeddedness (Trevor & Nyberg, 2008).

Finally, the workload, workflow, and psychological disruptions caused by increases in turnover rates are likely to be particularly damaging in retail settings, such as our sample, because collaborative customer service enhances unit performance (Schneider, White, & Paul, 1998). Service contexts are unique due to four conditions: coproduction (service depends on interaction between an employee and a customer), heterogeneity (customers have diverse service expectations), intangibility (the service is in the mind of the customer), and perishability (the experience cannot be stored and "enjoyed" later) (Moeller, 2010; Schneider & White, 2004). In large retail establishments, excellent service requires teamwork, backing up, and coordination because customers tend to perceive employees interchangeably (Gutek, Bhappu, Liao-Troth, & Cherry, 1999; Liao & Chuang, 2004). Hence, it is critical that there be consistent service delivery. High turnover rates disrupt relationships among employees because they erode explicit and tacit knowledge of coworkers and customers, transactive memory, cohesion, and collaboration and teamwork (Shaw et al., 2005). Yet, turnover rate increases imply additional cumulative effects (Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2006): wait times increase, quality and satisfaction decrease, and loyalty erodes. These effects compound such that fewer customers enter the store due to negative word of mouth; those remaining spend less time shopping and purchase less (Reichheld, 1991; Schneider, Ehrhart, Mayer, Saltz, & Niles-Jolly, 2005).

For example, consider two retail stores with 12% turnover rates. Traditional turnover rate studies would predict that the turnover rate effect on unit performance would be the same for both units (all else equal). However, if one unit was experiencing a 10 percentage point increase in turnover rates (i.e., from 2% to 12%) and the other was experiencing a 10 percentage point decrease in turnover rates (i.e., from 22% to 12%), the expected unit performance impact should be different between the two units. The unit with an increasing turnover rate should see a decrease in its ability to deliver quality service compared to the unit with decreasing turnover. This service deterioration leads to growing customer frustration corresponding with lowered desire to be in the store, lower spending, and increased negative word of mouth (Reichheld & Sasser, 1990).

Thus, we expect that turnover rate and turnover rate change are distinct. We do not suggest that the effects will be contradictory (at least so long as turnover rates are increasing), nor do we propose that turnover rate change is more important than static turnover rate levels. Rather, we propose that static turnover rates and turnover rate changes are distinct. They each capture different (but related) causes and thus both contribute uniquely to unit consequences.

Hypothesis 1. After accounting for turnover rate, turnover rate change is negatively related to changes in unit performance over time.

Hypothesis 1 provides the first empirical test regarding the turnover rate change–unit performance relationship. We next turn attention to understanding how these two influences interact. Drawing from CET theory, we propose that the effects of increasing turnover rates (change) are weaker when turnover rates are high than when turnover rates are low.

When turnover rates are high, units will be less sensitive to turnover rate changes because the constancy of turnover requires the development of routines and capabilities (Price, 1977). Units with high turnover rates create a culture where employees are not embedded (Felps et al., 2009), do not develop relationships with coworkers (Shaw et al., 2005), and do not identify with the firm (Trevor & Nyberg, 2008). In such turnover cultures, customer service suffers because it depends on collaboration, teamwork, transactive memory, and shared knowledge (Schneider & White, 2004). Increasing turnover rates in such units will matter less given that there is already less cohesion within the unit, and employees are relatively unattached to one another.

In contrast, increasing turnover rates will be more damaging when existing turnover rates are low. Units with lower turnover rates will have the potential for a stronger shared culture, tighter employee connections, and greater cohesion and teamwork (Kozlowski & Ilgen, 2006; Marks et al., 2001; Schneider, Smith, Taylor, & Fleenor, 1998). In such units, increasing turnover rates can create shocks that disrupt existing routines and require adaptation (Burke et al., 2006). Increasing turnover rates can erode the unit's processes (Marks et al., 2001). For example, a 10 percentage point increase in turnover rates may cause more disruption and hence be more detrimental to unit performance change for units with low baseline turnover rates (e.g., 5%) than for high baseline turnover rates (e.g., 80%). This is consistent with predictions by Price (1977) and Shaw et al., (2005), who found the relationship between turnover rates and unit performance was weaker at higher levels of turnover (i.e., an attenuated negative relationship). Thus, we hypothesize that increasing turnover rates are more damaging to unit performance at lower turnover rate levels.

Hypothesis 2. Turnover rates interact with turnover rate change to influence unit performance change. When turnover rates are high, the negative turnover rate change–change in unit performance relationship is weaker (less negative).

Hypotheses 1 and 2 establish the distinction between turnover rate and turnover rate change. In Hypotheses 3–5, we look at turnover rate change over time and the impact of two turnover rate properties (changes in quality and timing of departures) and two staffing properties (changes in quality and quantity of replacement hires). For all subsequent hypotheses, we include turnover rate, turnover rate change, and their interaction in all statistical models.

Quality of Turnover Rates

CET theory reconceptualizes the turnover rate definition to include both quantity and quality dimensions, with quality representing the unit competence or capacity lost. The idea is that some of turnover's consequences result from the accumulated loss of KSAOs (Nyberg & Ployhart, 2013). We therefore develop hypotheses around why the depletion of unit-level KSAOs qualifies the effects of turnover rates. In doing so, we provide the first empirical test of this CET theory claim, a claim that is consistent with both Shaw, Park, and Kim (2013), who stated that turnover represents the depletion of HCR, and with Hausknecht and Holwerda (2013), who stated that turnover diminishes the capacity of the unit.

Naturally, employees with higher-quality KSAOs are likely to contribute more to unit performance than are others (Ployhart, Van Iddekinge, & Mackenzie, 2011), and, collectively are more harmful to unit performance upon departure. For example, retail employees with better service skills are better able to anticipate customer needs, sell more products, provide higher-quality service, and collaborate with others more effectively (Chuang & Liao, 2010; Liao & Chuang, 2004), so it is expected that the quality of turnover rates will affect unit performance. This relationship has been discussed and examined in terms of high-performer turnover as an underlying determinant of unit-level outcomes (e.g., Nyberg, 2010; Shaw et al., 2005).

However, over time, changes in the quality of departures will also interact with turnover rate change to affect unit performance beyond static turnover rates. Naturally, logic underlying Hypotheses 1 and 2 regarding unit workload, workflow, and the psychological disruptions also applies here. However, CET theory further predicts that changes in turnover rate quality (e.g., increasingly losing high-quality employees) will exacerbate turnover rate change effects. First, increasingly losing high-quality employees will be even more disruptive as turnover rates increase because of the loss of the unit's capacity to perform exceptional service (e.g., Shaw et al., 2005), and also because of the signal it sends when higher-quality employees leave (Nyberg & Ployhart, 2013). This latter point is particularly important. If more valuable employees leave in greater numbers, then it negatively affects customer behavior, and can also produce a contagion effect (Felps et al., 2009). For example, the attraction–selection–attrition model (Schneider, 1987) predicts that organizations tend toward homogeneity, so, when high-quality people leave, it makes the remaining high-quality employees more likely to leave too, due to a worsening fit. Second, changes in turnover quality can shock routines. Increasing high-quality turnover suggests existing management policies are not working. Alternatively, reducing the loss of high-quality employees suggests that routines are working. For example, the workforce becomes more professional as HR practices and systems weed out lower performers and support higher performers (Jiang, Lepak, Hu, & Baer, 2012).

Thus, increasing turnover rates disrupt unit workload, workflow, and psychological processes. Increasingly higher-quality departures exaggerate these effects because workloads increase, coordination decreases, and turnover contagion among high-quality employees occurs, leading to sliding customer service quality, and, ultimately, lower customer purchasing. Therefore, we expect turnover rate changes involving an increase in higher-quality employees to be more detrimental to the relationship between turnover rate change and changes in unit performance than when the change in the quality of turnover rates is low:

Hypothesis 3. The negative relationship between turnover rate change and the change in unit performance is moderated by the quality of turnover. As turnover quality increases over time, the turnover rate change–change in unit performance relationship will be stronger (more negative).

Turnover Dispersion

Understanding *when* turnover events happen is also valuable, yet rarely considered (Heavey et al., 2013). This has led to the call for turnover rate research to examine the timing of turnover events including *when* they occur (Hancock et al., 2013; Nyberg & Ployhart, 2013).

Hausknecht and Holwerda (2013) proposed the idea of turnover event "dispersion," defined as the distribution of turnover events across time. High turnover dispersion is when events are more evenly distributed; low turnover dispersion means that turnover events are clustered. As an example, if 2 units each lose 12 employees in 1 year, by traditional measures, they would have the same turnover rate. However, if 1 unit loses 12 employees in 1 month (low turnover dispersion), while another loses 1 employee each month over 12 months (high turnover dispersion), theory predicts different performance consequences (Hausknecht & Holwerda, 2013; Nyberg & Ployhart, 2013). Greater turnover in a shorter time period (less dispersion) is likely to produce a stronger shock that overwhelms HCR capacity, harms the shared resource housed in their non-codifiable routines, and hinders communication and coordination (Nyberg & Ployhart, 2013). In turn, it takes time to recover and relearn such routines, and so recovery rates for less dispersed turnover events are expected to be longer.

Viewing turnover events within the context of CET theory suggests that changes in time dispersion should result in different consequences than should static time dispersion levels. If turnover events are increasingly clustered over time (negative change in time dispersion), it becomes more difficult to anticipate and prepare for shocks. This will further disrupt routines and make it more difficult to maintain workload, workflow, and psychological emergent processes such as cohesion and teamwork. Further, increasing the concentration of turnover events is likely to require units to either employ excessive personnel or retain a larger contingent workforce, both of which can reduce financial performance (Chadwick & Flinchbaugh, 2013). Responding to these shocks requires considerable adaptability for the unit, which, in turn, can increase stress (Burke et al., 2006), leading to decreased customer satisfaction and spending.

Hypothesis 4. The negative relationship between turnover rate change and the change in unit performance is moderated by turnover dispersion. As turnover dispersion increases over time (more dispersed), the turnover rate change–change in unit performance relationship will be weaker (less negative).

Staffing and Replacement Hires

HCR stock is simultaneously determined by human capital flows in and out of the unit (Reilly et al., 2014). However, the preceding logic—similar to most turnover rate research (see Hausknecht, Trevor, & Howard, 2009, and Reilly et al., 2014, for exceptions)—was presented without regard to HCR flows into the unit. In contrast, CET theory proposes considering replacement hires as a mechanism for reducing the HCR erosion (see Figure 1).

Quality of replacement hires. CET theory predicts that, if replacement hires collectively have higher-quality KSAOs than those leaving, then the HCR erosion is minimized. Thus, the quality of replacement hires should affect the turnover rate change–change in unit performance relationship (Hausknecht & Holwerda, 2013; Hausknecht et al., 2009). Indeed, scholarly reviews and a meta-analysis have found that higher-quality HCR contributes to higher unit performance (e.g., Crook, Todd, Combs, Woehr, & Ketchen, 2011; Nyberg, Moliterno, Hale, & Lepak, 2014). Employees with higher-quality KSAOs will perform more effectively, benefit more from training, and learn more quickly (Ployhart et al., 2011). Thus, the more highly skilled and knowledgeable the replacements, the more successful they will be at helping to recover from the loss of HCR.

However, HCR scholarship emphasizes the longitudinal flow over the stock at any particular point in time (Dierickx & Cool, 1989; Ployhart, Weekley, & Ramsey, 2009; Wright & Haggerty, 2005). HCR are capacities that are accessible for unit-relevant purposes (Ployhart, Nyberg, Reilly, & Maltarich, 2014), so enhancing the quality of replacements over time increases the unit's capacity. Increasing the HCR quality generates performance increases over time because higher-quality HCR provides a better and more consistent service, and hence contributes to customer satisfaction, spreading more positive word of mouth, and enhancing loyalty (Reichheld, 1991; Schneider et al., 2005). These improvements result in higher sales. Therefore, higher-quality replacements should lessen turnover rate change consequences. Constant turnover rates with increasing (positive) replacement hire quality should lead to positive improvements in the overall quality of KSAOs. Alternatively, it would be disastrous if replacement hire quality is low, because the HCR is then increasingly being depleted and could reach a point where there is insufficient capacity to perform. Thus, a change in the quality of replacements should affect the turnover rate change–change in unit performance relationship.

Hypothesis 5a. The negative relationship between the turnover rate change and the change in unit performance is moderated by the quality of replacement hires. As replacement hire quality increases over time, the turnover rate change–change in unit performance relationship will be weaker (less negative).

Quantity of replacement hires. Most prior HCR scholarship has focused on quality, but CET theory proposes that HCR quantity is also a distinct unit performance determinant (Nyberg & Ployhart, 2013). The logic underlying turnover rates is similar to the logic of quantity of replacement hires. According to CET theory, an erosion of HCR capacity occurs when turnover outpaces replacements. Alternatively, expansion of HCR capacity occurs when replacements outpace turnover (Nyberg & Ployhart, 2013). Indeed, Reilly et al. (2014) found that increasing hiring rates reduces average job demands. These reduced average job demands allow employees to focus more on their necessary responsibilities, which, in service contexts, can contribute to shorter customer wait times and better-quality service (e.g., Kacmar et al., 2006).

CET theory predicts that changes in the quantity of replacement hires will moderate the turnover rate change–change in unit performance relationship. If units can successfully match replacement hiring with changes in turnover rates, or potentially exceed those rates, they may be able to buffer some of the negative turnover rate change effects through the increase in slack employee resources (Chadwick & Flinchbaugh, 2013). However, when the quantity of replacements is high and turnover rate changes are small, CET theory predicts stronger positive unit performance benefits. In a retail setting, this may occur because there will be more available staff to provide service, reducing customer wait times and enabling staff to process customers more quickly. In contrast, when changes in the quantity of replacement hires are low, but turnover rate changes are high (e.g., replacement hires are lagging turnover rates), there is likely to be a negative unit performance effect. By incorporating replacement hires in our model, we examine one mechanism for mitigating the negative effects of turnover.

Hypothesis 5b. The negative relationship between the turnover rate change and the change in unit performance is moderated by the quantity of replacement hires. As the quantity of replacement hires increases over time, the turnover rate change–change in unit performance relationship will be weaker (less negative).

METHODS

Sample

Testing CET theory requires a suitable sample containing longitudinal data on both the quantity and quality of turnover rates and replacements. Further, consideration of turnover dispersion requires specific start and end dates for employees. Finding data that meets these requirements is difficult. In this study, data were acquired as part of an ongoing collection effort to explore unit effectiveness that resulted in a prior publication (Ployhart et al., 2009). The data overlap concerns primarily the sample used to create store-level variables, one of the independent variables, and the dependent variable. However, the current study examines new and very different research questions prompted by recent theoretical developments, is based on a new theoretical rationale, uses several newly created independent variables, and is analyzed using different statistical methods. Thus, as the theories and research questions differed between the two studies, so too do the specific variables and analytic methods. The data came from a prominent U.S. retail chain (Fortune 100). The organization competes on price, customer service, and product quality, distinguishing it from other large-scale purely discount retailers in which service delivery may not be as proximal in differentiating unit performance. We obtained data for four quarters in 2003 and one quarter in 2004, spanning over 15 months. Employee start and end dates were available to determine employment length. Each employee took the same selection tests measuring individual service orientation. Job analysis and criterion-related validity studies found that service orientation scores were job related for all departments. Individuals spanned ethnicities including Hispanic (15.28%), Asian (4.70%), Caucasian (58.05%), African American (20.94%), and Native American (0.73%). The majority of the sample was female (66%). Each employee was uniquely associated with a unit (n = 988). By using data from a single organization, we were able to hold constant management and HR policies, as well as contextual characteristics (e.g., industry), shown to influence the turnover rate–unit performance relationship (Shaw, 2011). In the retail sector in which our data were collected, the majority of employees were in roles with an O*NET job zone of one or two (e.g., cashiers, cart handlers, retail sales associates). We chose this low task-complexity, high turnover-rate environment because such environments are often accompanied by a larger pool of qualified workers, making it feasible to re-hire quickly. Units had *quarterly* turnover rates averaging 26% with high between-unit variance (SD = 12.13). This facilitated testing between-unit differences in performance based on within-unit differences in turnover. Unit-level adjusted controllable profit data followed the predictors by one quarter (i.e., predictor and criterion scores were lagged one quarter).

Measures

Unit performance. To measure *unit performance*, we used adjusted controllable unit profit (i.e., (sales–operating costs) × decimal constant). It was calculated on a quarterly basis, and represents an index of the unit's profitability under some management control. We focus on adjusted controllable unit profit because it captures latent positive financial benefit of turnover (i.e., decrease in payroll cost), while other measures such as unit sales do not. Please see Appendix A for an example and description of each measure. Multiplying controllable profit by a decimal constant (specific to this study) is used to mask the organization's true controllable profit numbers, but will not affect the shape of the distribution or any relationships with this variable because it is a linear transformation.

Turnover rate. *Turnover rate* was calculated by measuring quarterly voluntary turnover (Hausknecht & Trevor, 2011; Price, 1977). Due to data restrictions, we were only able to measure turnover among recently hired employees. Thus, our measure is the amount of voluntary turnover within each quarter among employees hired within the previous six-month period divided by the total number of employees who were hired within the same six months. We used the precise start and end dates to calculate whether a person was considered a new hire (i.e., hired within the most recent six months), and if he or she left the company within six months of the start date. Once an employee reached the 180-day tenure point, they were removed from the risk pool (the turnover rate denominator) to maintain consistency among the sample parameters. Thus, a person hired on Day 1 of our observation period, who subsequently voluntarily left the organization after one year, would be counted in the denominator part of the risk pool for the first 180 days, and would not be considered a turnover event in our study because they remained longer than 180 days. We focused on voluntary turnover because this is where units typically lose employees they would prefer to keep, and it is thus considered more harmful and regrettable than involuntary turnover (Shaw, Delery, Jenkins, & Gupta, 1998).

Turnover rate change. We calculated *turnover rate change* by subtracting the previous quarter's turnover rate from the subsequent quarter's turnover rate. For example, if the current quarter had a turnover rate of 25% and the previous quarter had a turnover rate of 10%, we calculated the turnover rate change by subtracting 10% from 25%, resulting in a turnover rate change of 15%. This process was repeated across all five quarters, hence allowing us to model changes across the entire time period. We recognize the challenges often associated with difference scores (e.g., Edwards, 2001; Edwards & Parry, 1993). In longitudinal settings, these concerns reduce to the reliability of the difference score (Cronbach & Furby, 1970; Rogosa, Brandt, & Zimowski, 1982). However, where the difference in the value of the variable across time *is* the construct of interest, it can be appropriate to use this score (Nyberg, Fulmer, Gerhart, & Carpenter, 2010; Tisak & Smith, 1994). Further, given that the objective nature of the turnover measure is likely to be reliable, the use of difference scores for this analysis seems appropriate. Thus, we use this measure because it is important theoretically, is conceptually the most accurate representation of the intended construct, and is a meaningful metric used by this and similar organizations. Note that the predictor measure is not based on differences across just two quarters, but, rather, on differences across the entire range of quarters, and thus is an index of change.

Quality of turnover. To measure the *quality of turnover*, we aggregated the individual service orientation of those who voluntarily left each unit, per quarter. An individual service orientation assessment was part of each unit's selection process, and was measured with the Kenexa Retail Associate Selector. As described in Ployhart et al. (2009), the assessment produces a composite score based on emotional stability, agreeableness, conscientiousness (15 items each), situational judgment (20-item scale), and educational success. Prior research has supported the importance of these personality constructs and situational judgment tests as strong predictors of service performance (Frei & McDaniel, 1998; Hogan, Hogan, & Busch, 1984), while educational success captures basic quantitative and verbal skills necessary for a retail environment. Service orientation raw scores were converted to *t* scores. The composite internal consistency reliability was .81, with the subscales ranging from .71 to .79, except for the situational judgment test, which was .47. This is typical for these types of assessments (Campion, Ployhart, & MacKenzie, 2014). The assessment is based on a relevant job analysis, and scores on the assessment demonstrated a reasonable effect size—an uncorrected criterion-related validity of .23 in a sample of 2,937 employees.

Employees were hired based on their assessment scores. While this creates the possibility of range restriction on the predictor, this concern is lessened to a degree because the organization only screened out the bottom end of the distribution. To examine the reliability of unit-level service orientation, we calculated the ICC(2). The ICC(2) of service orientation was .83, which demonstrates sufficient reliability to use unit-level means (LeBreton & Senter, 2007). Once we aggregated the service orientation of those that voluntarily turned over in each unit per quarter, we divided this by the number of employees who voluntarily turned over and multiplied it by −1 to get an average quality of turnover score for each unit, for each quarter.

Turnover dispersion. We used a Poisson distribution to fit daily turnover events per unit to measure the *turnover dispersion* within each quarter. We used this because, as is common with count data, the event distribution was not uniform or normal (i.e., the majority of days had 0 or 1 turnover events). We then generated a rate parameter (see Cohen, Cohen, West, & Aiken, 2003), which is the probability that a specific number of turnover events will happen per day (0.69, 0.25, and 0.05 probability for 0, 1, and 2 turnover events, respectively). We then ran a goodness-of-fit χ^2 test against the rate parameter for each unit's turnover data, for each quarter. The goodness-of-fit test resulted in a statistic (mean = 3.91, SD = 9.8) that was used as a measure of how often the turnover events deviated from the Poisson distribution. Each unit had a quarterly measure (i.e., time varying).

The Poisson distribution (with the number of turnover events happening in one day on the *x*-axis and the number of days with the corresponding number of departures on the *y*-axis) was positively skewed (to the left). This means it is more unlikely for deviation from the distribution to go in the "more dispersed" direction (near the apex of zero versus deviations in the tail of the distribution). To check that lack of fit was indicative of clustered turnover (and not both clustered and dispersed), we calculated how many quarterly observations met the following three conditions: (1) a higher-than-average test statistic (> 5.37), (2) a higher-than-average number of days with one turnover event (> 8.27), and (3) no days with more than one turnover event in one day. Less than 1% of units with quarters met this criterion (approximately .2%, or 13 quarters out of 5,073). Upon inspection of those units, they did not have much higher test statistics (mean = 6.92) than the average of the whole sample (mean = 5.37). Excluding these observations did not meaningfully change our results. Thus, higher numbers in the goodness-of-fit statistic were representative of more days with multiple turnover events outside the expected distribution (i.e., less time dispersed). As such, higher fit statistics represent less turnover dispersion (see Appendix B for example observations). The measure's range was restricted at zero and was thus centered and standardized for analysis.

Quality of replacement hires. *Quality of replacement hires* is based on the same service-orientation measure and aggregation procedures used to formulate the quality of turnover variable, but calculated the quality of replacement hires rather than the quality of leavers. By unit, we aggregated the service orientation of every hired employee in each quarter. We then divided this aggregate by the number of hires per quarter to get the quarterly average quality of hires. If an employee was hired and turned over in the same quarter, s/he was included in both the replacement hire and turnover calculations. We included them in both because they contributed HCR to the unit as well as extracted HCR upon departure.

Quantity of replacement hires. The *quantity of replacement hires* was created by aggregating the number of hires in each unit, per quarter.

Unit-level covariates. Seven covariates were included in the models to account for potential unit-level and economic influences to isolate the variables of interest. *Prior performance* was calculated in the same manner as performance (i.e., sales–operating cost) with the distinction that prior performance preceded unit performance by one quarter. *Replacement manager quality* was a time-varying, quarterly composite based on the product of (a) whether the unit hired a replacement manager ("0" = no replacement, "1" = replacement) and (b) the replacement manager's service orientation score. Thus, if a replacement manager(s) was hired, the score represents the service orientation score (average) for that manager(s). If a replacement manager(s) was not hired, a score of 0 was recorded. Note that only 311 (or 31%) of units replaced the manager (and hence had quality scores), so the mean level of replacement manager quality is considerably smaller than that found for the employees. Although it is a far from a desired measure of replacement manager quality, it may account for some variance attributable to managers (we discuss other limitations with this measure in the limitations section, below). This measure is missing many manager values, and we note that service orientation is not necessarily equivalent to manager quality, but we include it because it is the best way we can try to account for manager effects on both turnover and unit performance. *Unemployment rate* for each unit's zip code from the U.S. Bureau of Labor Statistics was obtained to account for the influence of the localized availability of labor (Nyberg, 2010; Trevor, 2001). *Retail density* was used to estimate the amount of retail competition facing a store in its local market (specifically, the number of retail establishments per square mile in each store's zip code). Since areas with more retail competition may have lower profits, we wanted to account for such competition. The *per capita income* for each store was derived by linking the store's zip code to U.S. Census Bureau databases. Per capita income parceled out the effects of more affluent locations. *Unit age* is the number of days that the store had been open. *Unit size* was calculated as the average headcount of unit employees for the year.

Data Analyses

Econometric models were used to test the Hypotheses. We did this using a random effects model for units over the five quarters. The following conceptual model represents the relationship between unit performance and turnover:

$$\begin{aligned} \textit{Unit prior performance}_{j(t+1)} = f\big(&\textit{turnover rate}_{j(t-1)}, \\ &\textit{turnover rate change}_{jt},\ \textit{unit performance}_{jt}, \\ &\textit{manager quality}_{jt},\ \textit{unemployment rate}_{jt}, \\ &\textit{retail density}_{jt},\ \textit{per capita income}_{jt}, \textit{unit age}_{jt}, \\ &\textit{unit size}_{jt}\big) \end{aligned} \tag{1}$$

where j is the unit, t is the time period, $(t - 1)$ is the prior time period, turnover rate represents the level of turnover per unit, turnover rate change represents the change in turnover from $t - 1$ to t per unit, unit prior performance is the level of performance per unit in the quarter, replacement manager quality is the average service orientation for all managers within a unit, unemployment rate is the unemployment rate for the zip code of each unit, retail density is the amount of retail competition facing each unit, per capita income represents the wealth in the zip code of each unit, unit age is the number of days that the unit was open, and unit size is the average headcount per unit during the study period. We tested all hypotheses using variants of Equation 1.

We used random effects because, theoretically, we expect that meaningful time invariant differences across stores for which we can account will influence our dependent variable (Greene, 2003). Additionally, it is likely that some omitted variables will be constant over time but will vary between cases, and that some fixed differences between cases will vary over time. To analytically check our expectations, we performed a Hausman test, where the null model is that the coefficients estimated by the fixed effects estimator are the same as those estimated by the more efficient random effects estimates. The result of this test suggested that we cannot reject the null hypothesis, as the unique errors were not correlated with the regressors ($p >$ .74), thus supporting the likelihood that the random effects model returns coefficients that are consistent but more efficiently generated than the fixed effects model. To further analytically confirm that we should use random effects regression rather than a simple ordinary least squares regression, we also tested for random effects using the Breusch–Pagan Lagrange multiplier. The result ($p < .001$) suggested that there are statistically significant differences across units, and, consequently, using the random effects model is preferable. Because the data are longitudinal, and our number of observations is large relative to our time intervals, we also clustered our data around "unit" and used the "robust" option to account for serial correlation and potential heteroskedasticity.

RESULTS

Descriptive statistics and correlations for unit-level variables are presented in Table 1. These are average aggregated values for quarterly variables included in the model. The correlations between turnover rate and unit performance are similar in magnitude to values found in recent meta-analytic findings (Hancock et al., 2013; Heavey et al., 2013; Park & Shaw, 2013). For example, this correlation is −.09 in our sample, which is similar to the uncorrected relationship of approximately −.10 in Park and Shaw (2013). This provides some confidence that relationships underlying the current data are consistent with those found in prior research.

Table 2 provides multivariate tests of turnover effects on unit performance through presenting the results of random effects regression analysis to test

TABLE 1
Correlations and Descriptive Statistics

Variable	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Unit performance	1,908,566.00	809,251.20	—													
2. Prior performance	1,837,626.00	805,239.30	.78	—												
3. Replacement manager quality	0.32	0.57	−.04	−.08	—											
4. Unemployment rate	5.74	1.45	−.07	−.07	−.05	—										
5. Retail density	12.79	17.64	.22	.21	.00	.10	—									
6. Per capita income	24,513.46	7,775.03	.31	.32	.09	−.16	.17	—								
7. Unit age	4,515.74	2,582.73	−.17	−.16	−.06	.11	.11	−.12	—							
8. Unit size	196.50	61.57	.73	.72	−.05	−.03	.20	.28	−.20	—						
9. Turnover rate	26.00	12.13	−.09	−.04	.00	−.09	−.01	−.05	.06	−.10	—					
10. Turnover rate change	6.66	18.10	.02	.20	−.04	.01	.00	−.02	−.01	.01	−.63	—				
11. Quality of turnover	−55.17	3.20	−.02	.02	.01	−.02	−.03	−.02	.06	−.03	.02	.03	—			
12. Turnover dispersion	5.37	10.85	.18	.24	−.02	−.04	.02	.04	−.06	.16	−.07	.28	.04	—		
13. Quality of replacements	54.64	2.52	.01	.00	.02	.02	.04	.01	−.05	.01	.01	.00	−.46	−.01	—	
14. Quantity of replacements	27.10	18.04	.49	.10	.05	−.04	.04	.05	−.13	.33	−.07	−.08	−.05	.15	−.01	—

Note: N = 2,592 observations (aggregated by stores across quarters). Correlations with absolute values above .04 are statistically significant at $p < .05$. The values in this table are averages of quarterly scores.

Hypotheses 1 and 2. Model l in Table 2 shows that prior performance, manager quality, retail density, per capita income, and unit size are statistically significantly related to unit performance. Supporting Hypothesis 1, after controlling for turnover rate, the turnover rate change coefficient was negative and statistically significant ($b = -9{,}427.79$, $p < .001$; Table 2, Model 3). A one standard deviation change in turnover rate change (18.10%) is associated with a loss of $170,642.99 (18.10 × −9,427.79) in quarterly adjusted profit (Cohen et al., 2003), equating to a loss of $682,571.99 per year—this understates the true loss, because, as stated above, we systematically reduced unit profits to shield the company's true profits. While this may seem small, for units where margins are very thin, this represents 8.9% of yearly profits (682,571.99/(1,908,566.00 × 4)).

To test Hypothesis 2, we interacted turnover rate with turnover rate change. The coefficient for the interaction term was statistically significant ($b = 59.12$, $p < .001$; Table 2, Model 4), thus providing support for Hypothesis 3. However, we note that, although the interaction term is statistically significant, Figure 2 suggests that this interaction is modest.

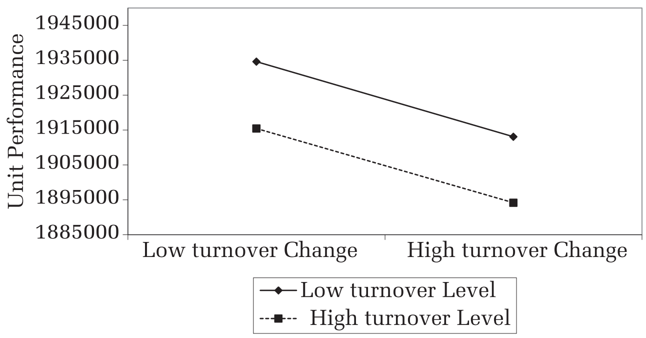
The results of testing Hypotheses 3 and 4 are presented in Table 3. Model 3 tests Hypothesis 3—that the change in quality of turnover will moderate the relationship between turnover rate change and change in unit performance. The coefficient for the interaction term—quality of turnover by turnover rate change—is statistically significant ($b = -538.92$, $p < .01$), thus providing support for Hypothesis 3. We graphed this interaction by plotting the quality of turnover at both low (−11.44, or one standard deviation below the mean) and high (24.76, or one

TABLE 2
Results of Parsing the Effects of Turnover Rate and Turnover Rate Change in Predicting Unit Performance using Random Effects Regression

	Performance Model 1	Performance Model 2	Performance Model 3 (Hypothesis 1)	Performance Model 4 (Hypothesis 2)
Constant	1907923.21***	1907776.29***	1907473.34***	1915769.57***
	(7816.23)	(7822.56)	(7215.15)	(7903.21)
Prior performance	0.52***	0.52***	0.62***	0.62***
	(0.02)	(0.02)	(0.02)	(0.02)
Replacement manager	25601.45*	25909.16*	23441.26*	22717.35
Quality	(11797.63)	(11790.17)	(11698.84)	(11741.89)
Unemployment rate	−9821.52	−11679.59	−16427.90**	−15431.90**
	(6207.07)	(6267.18)	(5824.56)	(5835.51)
Retail density	1790.51*	1802.66*	1630.68*	1629.68*
	(801.99)	(808.75)	(723.38)	(717.62)
Per capita income	4.57***	4.41***	2.34*	2.35*
	(1.23)	(1.24)	(1.08)	(1.08)
Unit age	−5.72	−5.14	−3.45	−3.32
	(3.45)	(3.47)	(3.15)	(3.16)
Unit size	4370.09***	4309.81***	3290.90***	3319.88***
	(266.91)	(268.21)	(253.72)	(253.86)
Turnover rate		−2233.79**	−11591.53***	−10757.56***
		(693.74)	(858.19)	(883.28)
Turnover rate change			−9427.79***	−9618.33***
			(597.50)	(605.33)
Turnover rate × Turnover rate change				59.12**
				(17.95)
Wald χ^2	4638	4640	6502	6505
Prob > χ^2	.0000	.0000	.0000	.0000
R^2 (overall)	.6729	.6740	.6955	.6962
Change in R^2 (overall)		.0011	.0215	.0007

Note: N = 2,592 observations; 988 groups. Robust standard errors are in parentheses; two-tailed hypothesis tests.
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

FIGURE 2
Moderating Effects of Turnover Rate Change and Turnover Rate over Time (Hypothesis 2)



standard deviation above the mean) levels of turnover rate change. As can be seen in Figure 3, the slope of the turnover rate change–change in unit performance relationship was more negative when turnover involved higher-quality employees. The unit performance difference between high and low turnover rate change among units with high-quality turnover was \$405,248 (\$2,090,709 − \$1,685,461) per quarter, compared with a difference of \$280,392 (\$2,086,068 − \$1,805,676) per quarter for units with low-quality turnover. Therefore, the additional loss associated with turnover rate change when it was classified as high-quality turnover versus low-quality turnover was \$124,856 (\$405,248 − \$280,392), or 45% (\$124,856/280,392). Thus, units with high-quality turnover suffered larger unit performance losses as turnover rates increased compared to the losses for units with low-quality turnover.

Hypothesis 4 posited that, when turnover dispersion was increasing (turnover events were more evenly distributed), the turnover rate change–change in unit performance relationship would be less negative. The coefficient for the interaction term was statistically significant ($b = -315.97$, $p < .001$) (Table 3, Model 6), thus providing support for Hypothesis 4. As Figure 4 illustrates, the slope of the turnover rate change–change in unit performance relationship was more negative when turnover rates were less dispersed. The unit performance difference between high and low turnover rate change among units with low turnover dispersion averaged \$509,486 (\$2,254,674 − \$1,745,188) per quarter, compared with a difference of \$261,279 (\$1,964,666 − \$1,703,387) per quarter for units with high turnover dispersion. Therefore, the additional loss associated with turnover rate change when it consisted of low turnover dispersion versus high turnover dispersion was \$248,207, or 95% (\$248,207/\$261,279). Thus, units with high turnover dispersion suffered smaller unit performance losses as turnover rates increased compared to the losses for units with low turnover dispersion. As seen in Model 7, these results remain intact when considering all of the turnover variables in the same model.

Hypothesis 5a (Table 4, Model 3), which predicted that, when replacement quality was increasing, unit performance would suffer less from an increase in turnover rate change, did not show a statistically significant interaction effect using a two-tailed hypothesis test. Although the effect for replacement quality was positive and statistically significant when using a one-tailed test ($p < .05$), we used the more conservative two-tailed tests for all hypothesis tests, and thus do not claim support for this hypothesis. Figure 5 provides a graphical representation of this interaction. It is also worth noting that the longitudinal relationship between replacement quality and future profit was, when modeled by itself with controls, positive (with diminishing returns) and statistically significant, as found in prior human capital research (e.g., Ployhart et al., 2009; see also Table 4, Model 7).

Hypothesis 5b (Table 4, Model 6), which predicted that, when replacement quantity was increasing, unit performance would suffer less from an increase in turnover rates, was not supported—the coefficient was statistically significant ($p < .05$), but in the opposite direction from that which we predicted. This may have been because, at low levels of turnover and high quantities of replacements, units can be overstaffed to the point that labor costs exceed their marginal value. There was, however, a strong direct relationship between replacement quantity and unit performance, which is consistent with the results found by Reilly et al. (2014). As seen in Model 7, these results remain largely intact when considering all of the replacement hire variables in the same model. However, Model 8 includes all of the variables used in both turnover and replacement hire hypotheses, and, although the effect sizes remain largely intact, many of the interaction terms are no longer statistically significant (possibly due to reduced statistical power).

DISCUSSION

This study builds on CET theory (Nyberg & Ployhart, 2013) to examine how changes in turnover rates over time advance our understanding of

TABLE 3
Turnover Quality and Time Dispersion Interactions with Turnover Rate and Turnover Rate Change Effects on Unit Performance using Random Effects Regression

	Performance Model 1	Performance Model 2	Performance Model 3 (Hypothesis 3)	Performance Model 4	Performance Model 5	Performance Model 6 (Hypothesis 4)	Performance Model 7 (Full turnover)
Constant	1915721.07***	1915664.34***	1916979.11***	1916320.75***	1916061.40***	1929061.11***	1929867.13***
	(7886.16)	(7889.81)	(7930.08)	(7949.97)	(7953.69)	(8390.05)	(8438.06)
Prior performance	0.62***	0.62***	0.62***	0.62***	0.62***	0.62***	0.62***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Replacement manager quality	23118.03*	23190.80*	23282.46*	22243.06	21941.75	18237.05	18881.79
Quality	(11635.39)	(11621.88)	(11570.53)	(11739.69)	(11738.47)	(11526.20)	(1138.95)
Unemployment rate	−15601.13**	−15603.84**	−15445.57**	−14920.80*	−14723.86*	−13957.55*	−13985.59*
	(5870.95)	(5869.36)	(5883.66)	(5793.63)	(5812.33)	(5871.37)	(5910.88)
Retail density	1598.00*	1584.75*	1559.38*	1657.31*	1658.50*	1717.15*	1644.60*
	(720.12)	(721.52)	(717.88)	(711.14)	(713.51)	(705.22)	(706.47)
Per capita income	2.32*	2.30*	2.23*	2.40*	2.39*	2.16*	2.04
	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)	(1.09)
Unit age	−2.96	−2.91	−2.64	−3.06	−3.00	−2.19	−1.49
	(3.15)	(3.16)	(3.15)	(3.15)	(3.15)	(3.16)	(3.15)
Unit size	3305.70***	3306.73***	3339.52***	3266.62***	3262.23***	3182.31***	3197.37***
	(253.92)	(254.10)	(254.32)	(252.14)	(251.71)	(251.71)	(251.77)
Turnover rate	−10721.47***	−10701.54***	−10611.80***	−11168.13***	−11141.08***	−11524.73***	−11386.20***
	(884.90)	(883.40)	(885.98)	(886.66)	(886.67)	(907.64)	(909.10)
Turnover rate change	−9585.54***	−9575.62***	−9470.16***	−10281.20***	−10267.86***	−10645.92***	−10517.84***
	(605.50)	(605.38)	(608.01)	(634.77)	(636.28)	(649.80)	(651.13)
Turnover rate change × Turnover rate	58.90**	59.08**	59.14**	63.50***	56.36**	41.50*	41.50*
	(18.00)	(17.91)	(18.04)	(18.01)	(19.07)	(19.08)	(19.11)
Quality of turnover	−4959.56	−5299.56	−9029.17**				−9215.31**
	(2643.94)	(2737.97)	(2739.43)				(2744.06)
Quality of turnover × Turnover rate		129.81	−432.88				−372.92
		(144.42)	(253.70)				(245.79)
Quality of turnover × Turnover rate change			−538.92**				−492.76**
			(178.07)				(175.45)
Turnover dispersion				2841.15***	2971.82***	7645.35***	7656.51***
				(811.88)	(789.33)	(1494.34)	(1506.08)
Turnover dispersion × Turnover rate					80.57	−178.97	−167.74
					(72.97)	(112.12)	(117.14)
Turnover dispersion × Turnover rate change						−315.97***	−309.08***
						(69.82)	(70.95)
Wald χ^2	6510	6517	6522	6535	6688	6172	6212
Prob > χ^2	.0000	.0000	.0000	.0000	.0000	.0000	.0000
R^2 (overall)	.6966	.6967	.6975	.6975	.6975	.7008	.7020
Change in R^2		.0001	.0008		.0000[a]	.0033[b]	

Note: N = 2,592 observations; 988 units. Robust standard errors are in parentheses; two-tailed hypothesis tests.

[a] Compared to Model 4.

[b] Compared to Model 5.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

FIGURE 3
Moderating Effects of Turnover Rate Change and Turnover Quality over Time (Hypothesis 3)

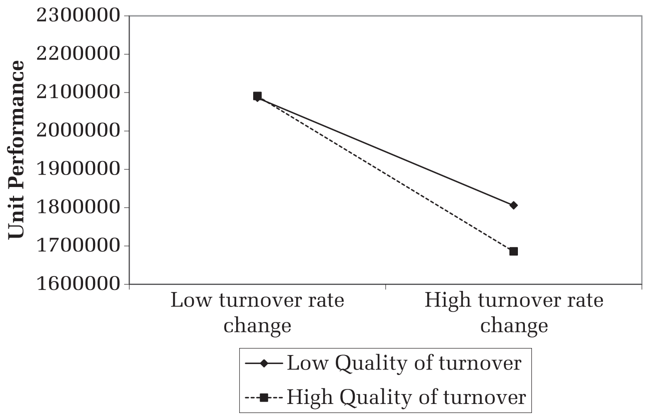
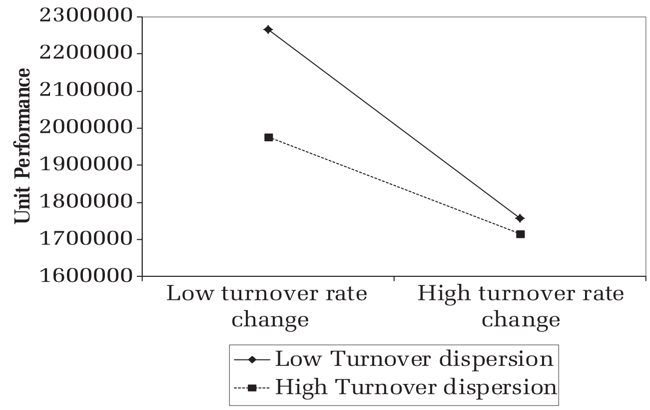


FIGURE 4
Moderating Effects of Turnover Rate Change and Turnover Dispersion over Time (Hypothesis 4)



how, why, and when turnover rate changes influence unit-level consequences. CET theory (Nyberg & Ployhart, 2013) posits that turnover rate quantity and quality, and replacement quantity and quality, interact within a dynamic system to influence performance change. Change in these properties over time affects unit workload, workflow, routines, and psychological emergence (e.g., climate, cohesion), hence explaining how and why turnover rate change influences unit performance. We also drew from Hausknecht and Holwerda (2013) by proposing that changes in turnover dispersion would affect the consequences of turnover rate changes, helping to explain when and how turnover events affect performance. Using a sample of 988 units and 108,357 employees, we found that (a) turnover rates and turnover rate change are empirically distinct, relating to unit outcomes both additively and non-additively; (b) the effect of turnover rate change on change in unit performance is moderated by changes in the quality of turnover; and (c) turnover dispersion moderates the effects of turnover rate change, such that more distributed turnover events weaken the negative effects of turnover. We failed to find support for our hypotheses about replacement quantity and quality, but a one-tailed hypothesis test for the quality interaction would have been statistically significant, and quantity's direct effect was strongly related to performance.

Theoretical Implications

There are nearly 150 articles linking turnover rates to unit outcomes (Hancock et al., 2013; Heavey et al., 2013; Park & Shaw, 2013), yet fewer than 15% of these are collected longitudinally, and none make explicit the study of turnover rate change over time. CET theory and frameworks by Hausknecht and Holwerda (2013) give greater emphasis on these temporal dynamics, operationalizing turnover as just one element within a broader system of HCR inflows and outflows that is summarized in Figure 1. While we did not anticipate that turnover rate change would produce dramatically different effects than cross-sectional tests, CET theory does predict that change in turnover rates is likely to capture variance distinct from static turnover rates.

First, we proposed distinctions between static turnover rates and turnover rate changes, such that they combined to influence changes in performance over time. Turnover rates and turnover rate change were correlated at −.63, which could raise questions about their distinctiveness. However, turnover rate and turnover rate change were both statistically significant in each of the 17 models in which they appeared together, and the coefficients for the interaction terms were statistically significant in 11 of the 16 relevant models—only in models including replacement quantity was this interaction not statistically significant. The interaction suggests that turnover rates define the nature of the turnover–performance relationship, as change in rates mattered less when those rates were high. This logic, first put forth by Price (1977), is finding growing support in the literature (e.g., Shaw et al., 2005, 2013). Based on CET theory, we argued that turnover rate change captures variance in disruptions not as observable with static turnover levels. Even though some of these explanatory processes may be the same for turnover rate and turnover rate change

TABLE 4
Quantity and Quality of Replacement Hire Interactions with Turnover Rate and Turnover Rate Change Effects on Unit Performance using Random Effects Regression

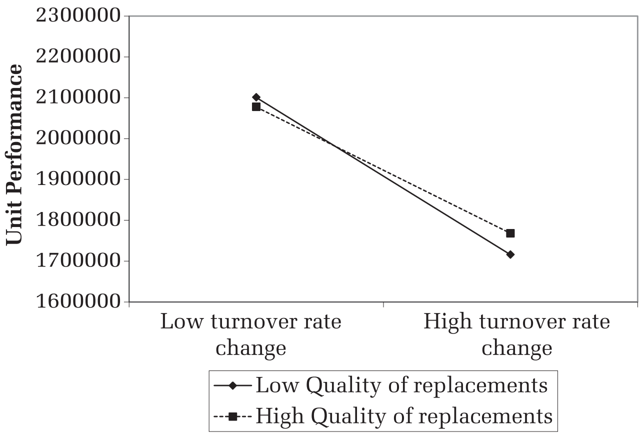
	Performance Model 1	Performance Model 2	Performance Model 3 (Hypothesis 5a)	Performance Model 4	Performance Model 5	Performance Model 6 (Hypothesis 5b)	Performance Model 7 (Full replace)	Performance Model 8 (Full)
Constant	1915719.57***	1915730.51***	1915519.01***	1909974.05***	1909705.68***	1902801.55***	1902716.14***	1905831.22***
	(7894.08)	(7890.55)	(7892.65)	(6903.62)	(6881.38)	(6713.71)	(6739.84)	(7245.69)
Prior performance	0.62***	0.62***	0.62***	0.71***	0.71***	0.71***	0.71***	0.72***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Replacement manager quality quality	22468.77	22474.81	22091.14	−3094.52	−2760.88	−3361.27	−4039.371	−4693.26
	(11707.24)	(11704.95)	(11739.08)	(10274.68)	(10237.43)	(10213.08)	(10224.67)	(10194.74)
Unemployment rate	−15576.45**	−15576.55**	−15281.95**	−7049.67	−7417.53	−7477.45	−7507.38	−7410.85
	(5847.71)	(5848.83)	(5869.49)	(4585.72)	(4584.07)	(4603.09)	(4624.57)	(4617.51)
Retail density	1605.58*	1604.28*	1589.78*	1475.68*	1491.24**	1483.39**	1433.86*	1440.63*
	(720.68)	(720.58)	(719.57)	(573.41)	(575.76)	(558.97)	(562.85)	(565.76)
Per capita income	2.35*	2.35*	2.34*	3.80***	3.77***	3.61***	3.60***	3.53***
	(1.09)	(1.09)	(1.09)	(0.97)	(0.97)	(0.96)	(0.97)	(0.96)
Unit age	−3.11	−3.10	−3.00	3.59	3.44	3.69	4.11	4.20
	(3.17)	(3.18)	(3.17)	(2.55)	(2.55)	(2.52)	(2.53)	(2.53)
Unit size	3318.52***	3318.20***	3337.43***	926.00***	919.36***	907.21***	916.57***	912.90***
	(253.63)	(253.63)	(255.27)	(206.62)	(208.41)	(206.50)	(207.78)	(208.08)
Turnover rate	−10787.39***	−10790.74***	−10759.29***	−9063.86***	−9141.05***	−9616.24***	−9632.19***	−9393.43***
	(880.38)	(883.21)	(885.16)	(833.08)	(836.35)	(853.08)	(856.77)	(862.02)
Turnover rate change	−9629.16***	−9629.85***	−9591.39***	−7851.58***	−7856.69***	−8348.86***	−8329.85***	−7952.92***
	(604.56)	(605.07)	(606.65)	(542.42)	(542.45)	(568.53)	(571.64)	(618.93)
Turnover rate change × Turnover rate	58.77**	58.75**	57.90**	14.84	20.33	14.57	13.42	1.82
	(17.96)	(17.97)	(18.05)	(14.14)	(14.58)	(14.04)	(14.00)	(14.78)
Quality of replacements	3306.52	3345.38	2878.91				5151.26*	4261.86
	(3283.84)	(3312.47)	(3395.75)				(2546.95)	(3088.77)
Quality of replacements × Turnover rate		−35.58	331.77				249.65	145.10
		(260.78)	(338.61)				(293.26)	(317.96)
Quality of replacements × Turnover rate change			413.71†				275.71	205.25
			(220.45)				(187.29)	(211.80)

TABLE 4
(Continued)

	Performance Model 1	Performance Model 2	Performance Model 3 (Hypothesis 5a)	Performance Model 4	Performance Model 5	Performance Model 6 (Hypothesis 5b)	Performance Model 7 (Full replace)	Performance Model 8 (Full)
Quantity of replacements				16814.05***	16755.93***	16351.28***	16371.66***	16505.86***
				(453.80)	(454.78)	(459.12)	(459.10)	(445.57)
Quantity of replacements × Turnover rate					−67.53 †	−199.53***	−195.78***	−184.61**
					(36.49)	(52.06)	(52.14)	(53.60)
Quantity of replacements × Turnover rate change						−151.71***	−148.65***	−132.30***
						(36.93)	(37.00)	(37.98)
Quality of turnover								−1416.82
								(2810.28)
Quality of turnover × Turnover rate								−221.63
								(225.07)
Quality of turnover × Turnover rate change								−107.96
								(169.35)
Turnover dispersion								−489.86
								(1322.69)
Turnover dispersion × Turnover rate								26.02
								(80.15)
Turnover dispersion × Turnover rate change								−63.22
								(54.22)
Wald χ^2	6666	6673	6692	9264	9247	9241	9634	10275
Prob > χ^2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
R^2 (overall)	.6964	.6964	.6967	.8140	.8143	.8159	.8164	.8170
Change in R^2		.0000	.0003[a]		.0003[b]	.0016[c]		

Note: $N = 2{,}592$ observations; 988 units. Robust standard errors are in parentheses; two-tailed hypothesis tests.
[a] Compared to Model 2.
[b] Compared to Model 4.
[c] Compared to Model 5.
† $p < 0.10$
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

FIGURE 5
Moderating Effects of Turnover Rate Change and Replacement Quality over Time (Hypothesis 5a)



(e.g., workload disruptions), the fact that turnover rates are changing adds additional complexities (e.g., greater amounts of disruption, broken or ineffective routines) that require units to adapt and reconfigure their resources (e.g., Sirmon, Hitt, & Ireland, 2007). We were unable to measure any of these explanatory processes, and future research needs to more precisely hypothesize, measure, and test them within the broader resource framework. For example, perhaps the average level of turnover rate influences workload disruptions, whereas the turnover rate change influences workflow structure and emergent psychological processes (e.g., Felps et al., 2009).

Second, this study provides a test of the CET theory prediction that turnover rate quality moderates the effect of the turnover rate change–change in unit performance relationship. It is stunning that, after so many turnover rate studies, quality remains so rarely examined. The results found losing higher-quality employees increased the negative effect of turnover rates on unit performance. While perhaps not surprising, the fact that these effects are observed over time is novel and suggests the implications are lasting and cumulative (at least within the range of time examined in this study). Future research needs to examine more directly the nature, antecedents, and consequences of turnover rate quality separate from turnover rates. For example, are the relationships between turnover rate quality and quantity and performance linear or nonlinear? Are there contexts in which quality is more important than quantity, or vice versa? Finally, does turnover rate quality or quantity have different causes or different consequences?

Third, drawing from Hausknecht and Holwerda (2013), we proposed that increasing turnover dispersion would weaken the negative effect of turnover rate change on performance change. This prediction asks the question of whether the timing of turnover events influences performance. Turnover distributed over time has different consequences than clustered turnover events. This offers new insights that are obscured by static or even changing turnover rates. Simply put, *when turnover happens matters*, and having more turnover in a compressed period of time causes more negative consequences. Future research needs to consider further the issue of timing. For example, are there temporal asymmetries with respect to turnover dispersion, such that, as more turnover events happen close together, the recovery periods are longer? Many have noted the need for more research to identify the role of time, timing, and durations in HR (Gerhart, 2005; Wright & Haggerty, 2005). In a recent review, Ployhart and Hale (2014: 78–79) concluded:

> A knowledge of when things happen, why and how they happen, and for how long signifies the existence of an advanced scientific literature. The HR field has a long way to go before it is capable of discussing such issues in an informed manner.

Examining turnover dispersion represents a step in this direction.

Finally, the effects of replacements are curious. The results suggest that replacements may not moderate the turnover rate change–unit performance change relationship. While this is surprising, given prior research showing that turnover rates attenuate the effects of HCR (Kim & Ployhart, 2014; Reilly et al., 2014), the generally positive direct effects between HCR and unit performance are consistent with prior HCR research (Crook et al., 2011; Nyberg et al., 2014). Future research should try to untangle the nature of the replacement–turnover relationship. Closer examination of the timing of these relationships may be useful. For example, turnover rates may moderate the effects of HCR when turnover is observed *after* HCR replenishment, whereas turnover rates may be robust to replacement effects when they are measured simultaneously. Similarly, one may posit that the effects of turnover rates are stronger than HCR accumulation effects because turnover rate effects are more immediate than those due to HCR accumulation.

Managerial Implications

The retail organization in this study was challenged with high turnover rates, but the levels were similar to firms in this industry and other industries in which the barriers to entry are low (e.g., construction, quick-service restaurants). Turnover rates often have negative, and, as found in this study, lasting and cumulative unit performance effects. For example, in our study, a one standard deviation increase (18.10%) in turnover rate change was associated with an additional loss of 8.9% in profits. Thus, our modeling of dynamic turnover rates also offers practical implications.

First, managers should realize that both static turnover rates and turnover rate change inform the prevalence, nature, and consequences of turnover. Static turnover rates set the tone for the interventions and actions needed, as turnover rate change matters less when rates are high. In this situation, drastic actions may be necessary because modest changes are less likely to improve performance. In contrast, at lower turnover rates, small changes can matter. Thus, managers should be sensitive to small changes because these can accumulate into larger negative performance effects. For instance, small static levels of turnover provide employees time to develop communication and group cohesion to maximize performance (e.g., customer service). However, large changes to low rates may shock remaining employees, leading to performance disruptions. Hence, both rates and rate changes provide unique and diagnostic insights.

Second, managers should closely evaluate replacement-hiring procedures in conjunction with historic turnover rates because the timing of turnover events matter. By evaluating turnover patterns and proactively strategizing, managers may buffer turnover's negative impact. More broadly, staffing can potentially buffer turnover. It may be that managers should focus less time on retaining individual employees, and more on the collective HCR flows because unit-level "flow rates" may provide more information about how to manage unit performance. Additionally, better forecasting can also help avoid overstaffing and avoid unnecessary labor costs.

Third, extra efforts should be made to retain higher-quality employees because their loss creates greater negative cumulative effects on performance. Firms that have adopted HR policies based on commitment or equity may find it difficult to reduce turnover among top employees (Nyberg, 2010). Thus, firms may want to consider HR policies that differentiate employees based on their performance by providing opportunities for disproportionate performance-based rewards to higher-performing employees (Nyberg, Pieper, & Trevor, 2013).

Finally, managers should be attuned to the timing in which employees move in and out of the unit. There may be instances in which managers can anticipate turnover (e.g., the departure of seasonal employees), but, by observing trends over time in a more granular way (such as turnover dispersion), it becomes possible to take more specific actions. Effectively forecasting and then integrating turnover and staffing strategies will allow managers to mitigate the clustering of turnover events and avoid the exaggerated negative effects relative to more dispersed turnover.

Limitations and Future Directions

This work has limitations that need addressing. First, although we capture replacement quality using validated selection test scores, there are other ways to measure quality. However, the constructs assessed with this measure have been widely used and linked to service performance in prior research (Frei & McDaniel, 1998; Hogan et al., 1984; Ployhart et al., 2009).

Second, although we constructed our turnover dispersion measure based on theory, there are several alternatives. We ran robustness checks using different methods, but it is possible that our results are partially driven by decisions regarding how to calculate the scores. Future research may find better operationalizations, or find that operationalizations are sample specific. Our daily measure may miss turnover dispersion occurring over different temporal spans (e.g., weekly, monthly), and the measure may not be fully sensitive to the variations in the underlying construct. Additionally, if turnover dispersion is a useful predictor of unit performance, researchers should build theory about its antecedents (e.g., downsizing, seasonality).

Third, although there are some internal validity advantages to using a single organization in a single industry, thus ruling out some potential confounding influences, this may limit the generalizability of the findings. In particular, our data are from the retail industry, and it is conceivable that our results may not fully generalize to other companies or industries. Our data did, however, capture a broad selection of jobs (albeit none were senior management positions) that increases our findings' generalizability.

Replicating this study in different organizations and different industries (especially industries in which turnover rates tend to be lower) could both shed light on the robustness of the findings and on the role that job complexity has in affecting these results.

Fourth, generalizability may also be hampered by the specific context examined. In addition to being a large retail store, it also experienced extremely high turnover rates (mean turnover rate = 26% per quarter). While such high turnover rates allow opportunities for examining links between turnover rates and replacement hires, the lessons learned may not apply to organizations with substantially lower turnover rates. However, even if they were only applicable to organizations with high turnover rates, this would still apply to a sizeable portion of the low-wage occupations (e.g., fast-food restaurants, big box stores, small retail chains, etc.).

Fifth, along similar lines, the relatively low job complexity of most jobs in our data may also limit generalizability. In a setting such as ours where there is less tacit knowledge and replacements can be trained relatively quickly, turnover dispersion may function differently than when there are jobs that are more complex. Researchers may find that testing the timing of turnover in both high-complexity and low-complexity environments may yield different results.

Sixth, potential seasonality effects must also be considered. Our data spanned five quarters of a large retail organization that experiences seasonality effects associated with hiring, lay-offs, and performance, and hence can potentially influence these results. One mechanism for partially mitigating this concern is the proper specification of the correlated error structure (Findley, Monsell, Bell, Otto, & Chen, 1998), but future research should seek to test these relationships among data with multiple years of observations to adjust variables seasonally.

Seventh, potential endogeneity effects of managerial ability may be an omitted variable that could explain both turnover rate change and changes in unit performance. To account for this possibility, we tried to model managerial ability by including a "replacement manager quality" variable that captures a replacement manager's service orientation as s/he entered the unit. Unfortunately, this measure does not capture senior management influences, does not measure leadership ability, and is missing data because only the scores of replacement managers are available. Consequently, we do not want to over-interpret these results. We believe that this concern is partially mitigated by controlling for prior performance and examining relationships over time, but we cannot eliminate it.

Finally, our sample also consisted exclusively of new hires. While this is an ideal setting for examining the relationship between staffing and turnover rates, it may limit generalizability (i.e., perhaps our results only apply to new hires). However, new hires are a group of employees worthy of studying in and of themselves because they are at an exceptionally high risk of turnover compared to those with greater tenure (Nyberg, 2010). The challenges faced upon entering a new environment can be taxing: learning new skills, understanding new routines, figuring out unwritten norms, and creating new relationships. While it is relatively more beneficial to a unit to cut ties quickly if a new hire will not succeed (although there remain sunk costs associated with the hiring), it is detrimental if the employee could be valuable but leaves before that value has been appropriated. For 20 years, research has discussed the salience of understanding new hire turnover (e.g., Hom & Griffeth, 1995), yet this may represent the first empirical examination of the effect that new hire turnover has on unit performance

CONCLUSION

Collective turnover can have particularly important negative performance consequences. The current study addresses these consequences by testing CET theory predictions through modeling change effects in turnover rate quality and quantity, turnover dispersion, and replacement quality and quantity on unit performance over time. By testing these relationships longitudinally, we show how and when turnover rate change is more likely to harm unit performance over time, and how these negative effects can be exacerbated or attenuated. Turnover in the real world is embedded within context and time, and exploring these temporal dynamics will advance the theoretical rigor and practical relevance of turnover research.

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Matthew L. Call (matthew.call@grad.moore.sc.edu) is a doctoral candidate in the Management Department at the Moore School of Business, University of South Carolina. His research interests include the nature and consequences of human capital resources at multiple levels.

Anthony J. Nyberg (anthony.nyberg@moore.sc.edu) is an associate professor in the Moore School of Business at the University of South Carolina. He received his PhD from the University of Wisconsin–Madison. His research focuses on strategic human capital resources with emphases on performance, compensation, employee movement, and executive succession.

Robert E. Ployhart (ployhart@moore.sc.edu) is the Bank of America Professor of Business Administration at the Darla Moore School of Business, University of South Carolina. He received his PhD from Michigan State University. His primary interests include human capital resources, staffing, recruitment, and advanced statistical methods.

Jeff Weekley (jweekley@us.ibm.com) is the global leader of talent management and HR analytics for IBM's Smarter Workforce. He received his PhD in management science from the University of Texas at Dallas. His current research interests are in the area of talent acquisition.

APPENDIX A

Variables	Description	Calculation	Example
Unit performance	Quarterly store profit was sales minus operating costs multiplied by a decimal constant	(sales − operating costs) × decimal constant	If a store had sales of 1,270,000, operating costs of 300,100, and the decimal constant was .92, then profit would be calculated as (1,270,000 − 300,100) × .92 = $892,308.
Turnover rates	Employees that turned over in each quarter, divided by those hired in the previous six months for each store. An employee hired in the study period reaching a tenure of 180 days was removed from future calculations.	$\left(\frac{\text{number of employees turned over in current quarter}}{\text{employees hired within 180 days prior to the end of current quarter}}\right)*100$	If a store had 55 employees turnover in the current quarter and had hired 200 employees within 180 days prior to the end of the current quarter, then turnover would be calculated as 55/200 = (.275) × 100 = 27.5.
Turnover rate change	Turnover rate (as calculated above) minus turnover rate$_{t-1}$; across all quarters	(Turnover rate) − (turnover rate$_{t-1}$)	If turnover rate was 15% at Time 1 and 10% at $t-1$, then turnover rate change was 5%. Repeat for each quarter.
Quality of turnover	A quarterly measure of the average service orientation of employees that turned over in each store	$\left(\frac{\text{Sum of service orientation scores for all who turned over in current quarter}}{\text{\# of employees who turned over in current quarter}}\right)*-1$	If a store had 5 employees turnover with service orientations of 55, 56, 57, 96, and 45, then quality of turnover would be calculated as ((55 + 56 + 57 + 96 + 45)/5) −1 = −61.8
Turnover dispersion	The expected value for the number of turnover events for each day, for each store best fit a Poisson distribution. After calculating a rate parameter for the number of occurrences of daily turnover (the expected number of daily turnover events per store), we fit the actual daily turnover event occurrence to the expected using a goodness-of-fit χ^2 test. This resulted in a goodness-of-fit statistic (which represents the turnover dispersion variable) for each quarter per store.		See Appendix B, following, for an example of the calculation of a store within the data.
Quality of replacement hires	A quarterly measure of the average service orientation of employees that were hired in each store	$\left(\frac{\text{Sum of service orientation scores for all who were hired in current quarter}}{\text{\# of employees who were hired in current quarter}}\right)$	If a store hired 5 employees with service orientations of 75, 56, 89, 55, and 76, then quality of replacement hires would be calculated as (75 + 56+ 89+ 55+ 76)/5 = 70.2.
Quantity of replacement hires	The total quarterly amount of employees hired in each store	Number of employees hired in current quarter	If a store hires 45 people in the current quarter, then this score would = 45.

APPENDIX B

Example: One Unit's Quarterly Turnover Dispersion[a]

Number of turnover events on the same day	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Days with 0 turnover events	74	68	69	51
Days with 1 turnover event	13	20	21	27
Days with 2 turnover events	2	3	1	7
Days with 3 turnover events	0	1	1	4
Days with 4 turnover events	0	0	0	2
Days with 5 turnover events	0	0	0	1
Sum of turnover events in quarter	89	92	92	92
χ^2 goodness of fit	0.54	0.97	2.85	10.28

[a] Unit identifier is withheld to retain anonymity; note that, when units had more days with more turnover events (i.e., multiple people leaving on the same day), the resulting goodness-of-fit statistic is higher, representing less dispersion.