© Academy of Management Journal
2005, Vol. 48, No. 1, 50–68.

ALTERNATIVE CONCEPTUALIZATIONS OF THE RELATIONSHIP BETWEEN VOLUNTARY TURNOVER AND ORGANIZATIONAL PERFORMANCE

JASON D. SHAW
University of Kentucky

NINA GUPTA
JOHN E. DELERY
University of Arkansas

We propose four alternative predictions regarding the relationship between voluntary turnover and workforce performance and develop the hypothesis that safety and productivity outcomes mediate that relationship. In two intraindustry studies, strong support emerged for curvilinearity: the relationship between voluntary turnover and workforce performance is negative, but it is attenuated as turnover increases. Some modest support for workforce performance as a mediator of the voluntary turnover and financial performance relationship emerged. Implications for organization-level theory and research are addressed.

Four different theoretical patterns of the relationship between "voluntary turnover," or quit rates, and organizational performance can be gleaned from the scientific literature. These include the argument that voluntary turnover hurts organizational performance (Osterman, 1987; Penceval, 1972), that at least some level of voluntary turnover is needed and benefits organizational performance (Dalton & Todor, 1979), that the negative effects of voluntary turnover on performance are attenuated as the rate increases (Price, 1977), and that the turnover-performance relationship is contingent on an organization's human resource investments and inducements (Arthur, 1994; Guthrie, 2001). Thus far, there has been much more theorizing and speculation than systematic empirical testing concerning the veracity of these alternative conceptualizations. As Alexander, Bloom, and Nuchols noted, "There have been almost no empirical studies of the organizational consequences of turnover that either reinforce traditional conceptions of turnover as a negative attribute of organizational behavior, or affirm more recent notions" (1994: 506). We take steps in this direction here.

Platt advocated the "method of multiple hypotheses" (1964: 350) for addressing alternative explanations empirically. Simultaneous tests of alternative hypotheses about the relationship between voluntary turnover and organizational performance may advance understanding of this relationship and firm performance in general. Such tests may also be useful to inform managers' decisions about the implementation of human resources management (HRM) inducements and the investments necessary to achieve desired turnover rates (e.g., Abelson & Baysinger, 1984; Dalton & Todor, 1979; Shaw, Delery, Jenkins, & Gupta, 1998). In essence, such a study has the potential for broad utility, both theoretically and practically. We derive predictions for intermediate workforce performance measures—operationally defined as the organization-level outcomes of the behaviors (i.e., productivity and safety) of key employee groups. We also derive predictions for financial performance measures. First, we elaborate the four alternative theories on the voluntary turnover–workforce performance relationship. Second, we address "black box" issues by predicting that the relationship between voluntary turnover rates and financial performance is mediated by intermediate measures of workforce performance (e.g., Becker & Gerhart, 1996; Delery & Shaw, 2001). Third, we describe tests of the predictions in two intraindustry studies, conducted in the

This research was funded by the National Science Foundation (SBR-9422326; Study 1) and the Society for Human Resource Management Foundation (Study 2). The interpretations and conclusions in this paper are the authors' and do not necessarily represent the funding organizations. An earlier version was presented at the 2002 meeting of the Academy of Management, in Denver. The authors wish to thank Editor Tom Lee, three anonymous reviewers, Paul Jarley, Michelle Duffy, Nancy Johnson, members of SAPS, and seminar participants at the University of Kentucky, Cornell University, and Wayne State University for helpful comments on earlier versions.

trucking and concrete pipe industries. Fourth, we discuss the implications of the findings.

Our research was limited to core employee groups in each setting—that is, truck drivers and production workers. Core groups control production processes, deliver hands-on services, and operate key technology (Alexander et al., 1994; Delery & Shaw, 2001), factors central to determining the consequences of voluntary turnover. We focus on voluntary turnover exclusively, not on the sum of quit and discharge rates, since the etiology and consequences of these phenomena vary (e.g., Osterman, 1987; Shaw et al., 1998). Our theoretical predictions derive primarily from human capital theory, to the exclusion of other theoretical approaches (e.g., social capital theory) that are more applicable to knowledge-based organizations and top management groups (e.g., Dess & Shaw, 2001).

VOLUNTARY TURNOVER AND WORKFORCE PERFORMANCE: FOUR THEORETICAL ALTERNATIVES

Alternative 1: The Linear Negative Relationship

Human capital theory provides a formal platform for examining the voluntary turnover–workforce performance relationship. It suggests that the accumulation of firm-specific human capital embodied in a workforce determines workforce performance (Strober, 1990). Voluntary turnover eliminates an organization's return on its investment in an employee (that is, it results in the loss of a productive worker). Employees bear costs initially by accepting wages below their marginal revenue product in anticipation of high future wages, a return on investment not realized if the employees quit. An organization's firm-specific human capital accumulations are depleted by voluntary turnover, and because firm-specific human capital is an antecedent of workforce performance, it should decline as turnover increases. In terms of productivity, by reducing firm-specific skill levels, high voluntary turnover disrupts the input-throughput-output process in an organization and thereby reduces efficiency (Alexander et al., 1994). In terms of safety, high voluntary turnover redirects energy and resources away from maintenance and safety concerns to those necessary for simply sustaining product or service delivery (Staw, 1980).

From limited and mostly indirect evidence, Osterman (1987) concluded that a negative relationship between voluntary turnover and workforce performance was fairly well established. In the most direct test of the relationship reported in the literature, Brown and Medoff (1978) found a significant, negative relationship between quit rates and productivity, when initial labor quality, technology, and unionization were controlled for. In related evidence, voluntary turnover has been found to relate negatively to cost effectiveness in hospitals (Alexander et al., 1994), to profit per loan in financial services subunits (McElroy, Morrow, & Rude, 2001), and to sales performance in fast-food restaurants (Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2004). Overall, this perspective and limited empirical evidence suggest that voluntary turnover, by reducing firm-specific human capital, relates negatively to workforce performance. More formally,

Hypothesis 1a. There is a significant, negative relationship between voluntary turnover and workforce performance.

Alternative 2: The Inverted U-Shaped Relationship

Dalton and Todor (1979) questioned whether the effects of voluntary turnover on workforce performance are always negative. They outlined instead an "expanded and positive perspective" (Dalton & Todor, 1979: 225) representing a variation on human capital arguments, but also departing from purely cost-based assessments of the negative effects of turnover. Although the general effects of voluntary turnover on workforce performance are considered negative, these authors detail the benefits of some minimum level of turnover for such performance. In this perspective (as in human capital theory in general), high voluntary turnover is detrimental for workforce performance. At low to moderate levels, however, voluntary turnover can improve workforce performance by revitalization—that is, by increasing workforce innovation, flexibility, and adaptability (Abelson & Baysinger, 1984; Dalton & Todor, 1979). Very low quit rates can result in workforce skill stagnation, closed-mindedness, and "trained incapacity" (Dalton & Todor, 1979; Dubin, 1970) that in the aggregate reduce organizational productivity and increase accidents.

A comparison of the Dalton and Todor (1979) formulation and Hypothesis 1a shows that both predict a negative effect of turnover on productivity at high turnover levels. The predictions differ at low to moderate turnover levels. Hypothesis 1a suggests that any increment in voluntary turnover reduces firm-specific skill and experience levels in a workforce and thus lowers its performance. The second formulation posits that, because stagnation or trained incapacity is likely when voluntary turn-

over is low, some turnover is functional—some "changing of the guard" can enhance performance. Empirical evidence on the validity of this alternative formulation is very sparse. Osterman (1987) referred to three studies that examined this relationship, one of a basketball team, one of a kibbutz, and one of a single group of scientists, but he cautioned against generalization to organizational settings. Recently, Glebbeek and Bax (2004) found support for an inverted U-shaped relationship with total turnover and net sales among subunits of a temporary employment agency but warned about applicability to cross-organization situations. Between-organization tests of this proposition are needed. Thus:

Hypothesis 1b. The relationship between voluntary turnover and workforce performance is curvilinear: it is positive as voluntary turnover increases initially but becomes negative as turnover further increases.

Alternative 3: The Attenuated Negative Relationship

A third variation on the human capital theory foundation for the relationship between voluntary turnover and workforce performance builds on the sociological literature on turnover and on learning curve theory. On the basis of a review of the turnover literature, Price proposed that "successively higher amounts of turnover will be found ultimately to produce, more often than not, *successively lower amounts of effectiveness at a decreasing rate*" (1977: 119). Voluntary turnover affects workforce performance negatively by diminishing firm-specific human capital accumulations, but these losses are less severe, and their performance effects are ameliorated at high levels of turnover. With low turnover, the firm-specific human capital accumulations of *average* employees are quite high; a quit means that the organization, on average, is losing an employee who has "progressed down the learning curve." Like theory on firm-specific human capital, learning curve theory concerns skill and ability levels as they relate to reduced performance errors and high job-related memory retrieval (e.g., Logan, 1992; Ohlsson, 1986)—that is, they concern employee ability to perform at a level higher than that possible with simply an accumulation of general skills. When turnover is low, it is quite time-consuming for a new employee to build specific human capital that is equivalent to the average stayer's. When voluntary turnover is high, average firm-specific human capital accumulations are low by definition. Replacements can build equivalent human capital and attain the level of performance of leavers quickly. Thus, when voluntary turnover rates are high, an organization typically replaces a *short*-tenured employee (with few firm-specific skills) with a new employee who soon represents the same level of human capital accumulation and shows equivalent performance.

This formulation can also be viewed through the lens of organizational control. As voluntary turnover reduces skill levels, input-throughput-output processes are disrupted, and an organization directs energy and resources away from safety concerns in order to maintain operations. When turnover is very high, however, the organization is geared toward continual workforce replacement, and increases in voluntary turnover beyond some point are minimally disruptive. When the workforce is being constantly replaced (for example, the turnover rate is 100 percent), marginal increases in voluntary turnover (such as to 110 percent) are proportionally less problematic in terms of productivity and safety than increases at lower average turnover rates (e.g., from 10 to 20 percent).

Price's (1977) formulation has two primary differences from the negative linear formulation. The linear formulation relies on an assumption of a constant loss of firm-specific human capital across the range of voluntary turnover and a consistently negative effect on performance. By contrast, this curvilinear formulation suggests a *stronger* negative effect on performance than the linear formulation when quit rates increase from low to moderate levels (when most of the firm-specific human capital is lost) and *weaker* or attenuated effects as quit rates continue to increase (when little firm-specific human capital is lost). This argument implies that a linear formulation underestimates the effects of quit rates at low levels and overestimates the effects at high levels. This is also not the reverse of Hypothesis 1b. Hypothesis 1b predicts performance benefits for low turnover, but the attenuated negative relationship approach does not predict marked performance improvement for high turnover. The prediction is not for a sharp U-shaped relationship, but rather for a "floor" with a predominantly negative slope.

Hypothesis 1c. The relationship between voluntary turnover and workforce performance is curvilinear and is such that the relationship is generally negative and is attentuated as turnover rates rise.

Alternative 4: The HRM-Moderated Relationship

A fourth perspective on the relationship between voluntary turnover and workforce performance is

found in the strategic HRM literature. In this view, the consequences of turnover for workforce performance vary as a function of investments in HRM practices (Arthur, 1994). Of particular importance are those HRM practices that ensure a high-quality human capital pool, termed *investments,* and those that enhance retention, termed *inducements* (Shaw et al., 1998). Investment-oriented HRM practices are those, like training, that directly contribute to human capital accumulations over time, and those, like job stability, that indirectly do so. These practices also contribute directly to the firm-specific nature of employee skills by increasing knowledge of an organization's products or services and specific work processes, technologies, and techniques (Batt, 2002). Inducement-oriented HRM practices include direct practices, such as high pay and benefits, and indirect practices, such as procedural justice and voice mechanisms (e.g., Freeman & Medoff, 1984; Shaw et al., 1998).

Arthur (1994) argued that HRM systems moderate the relationship between turnover and workforce performance in such a way that the relationship would be stronger among organizations whose HRM systems were characterized by the use of inducement- and investment-oriented HRM practices, labeled "commitment systems." High voluntary turnover disrupts input-throughput-output processes more in organizations where HRM investments and inducements are high than it does in those where these are low. In "high-commitment organizations," employees play more pivotal or critical roles, whereas in organizations characterized by low investment in inducement and investment practices ("control systems"), employees are treated more like replaceable commodities (Guthrie, 2001). Thus, the relationship between voluntary turnover and workforce performance should be significant and negative when HRM inducements and investments are high, and thus when quits may create great disruptions. By contrast, the voluntary turnover–workforce performance relationship should be attenuated when inducements and investments are low, because this approach minimizes the impact of labor on the process (Guthrie, 2001). Research offers scanty evidence in support of this prediction, notably Arthur's (1994) study of steel "minimills" and Guthrie's (2001) replication of that work among organizations in New Zealand. Thus:

Hypothesis 1d. A negative relationship between voluntary turnover and workforce performance is moderated by HRM inducements and investments in such a way that it is attenuated when HRM inducements and investments are low.

Figure 1 (Hypotheses 1a–1c) and Figure 2 (Hypothesis 1d) depict these alternative conceptualizations of the relationship between voluntary turnover and workforce performance.

VOLUNTARY TURNOVER AND FINANCIAL PERFORMANCE: WORKFORCE PERFORMANCE AS A MEDIATOR

Researchers have recently called for theoretical elaboration of the black box area that lies between organizational practices, strategy implementation, and workforce characteristics on the one hand and the ultimate financial performance of organizations on the other (e.g., Becker & Gerhart, 1996; Delery & Shaw, 2001). We expect workforce performance to mediate the relationship between voluntary turnover and financial performance. Implicit in the derivation of Hypotheses 1a–1d is that voluntary turnover rates relate to workforce performance outcomes (although the form of the relationship is an open theoretical and empirical question), but that lower workforce performance levels will be manifested in lower profitability levels. Huselid (1995), for example, reported significant, negative correlations between total turnover and productivity and small, positive correlations between productivity and financial performance, but he did not examine a mediation framework.

The nature of the mediation is contingent upon the results from the alternative hypotheses outlined above: that is, work force performance may mediate a direct linear relationship, a curvilinear relationship, or a relationship moderated by HRM practices. We anticipate only partial mediation of the effects of voluntary turnover by workforce performance. Voluntary turnover could affect financial performance directly in many ways. For example, such turnover could increase administrative intensity and other costs in addition to lowering workforce performance (e.g., see Alexander et al., 1994). The interaction of voluntary turnover and HRM practices could influence financial performance directly through a trade-off whereby the harmful effects of turnover "are just matched by the wage, hiring, and training costs associated with that turnover rate" (Pencavel, 1972: 57). The interaction could also affect financial performance directly, since voluntary turnover–HRM practice mismatches are likely to lower profits (Osterman, 1987). Thus, we expect the relationship between voluntary turnover and financial performance to be

FIGURE 1
Alternative Forms of the Relationship of Voluntary Turnover and Workforce Performance

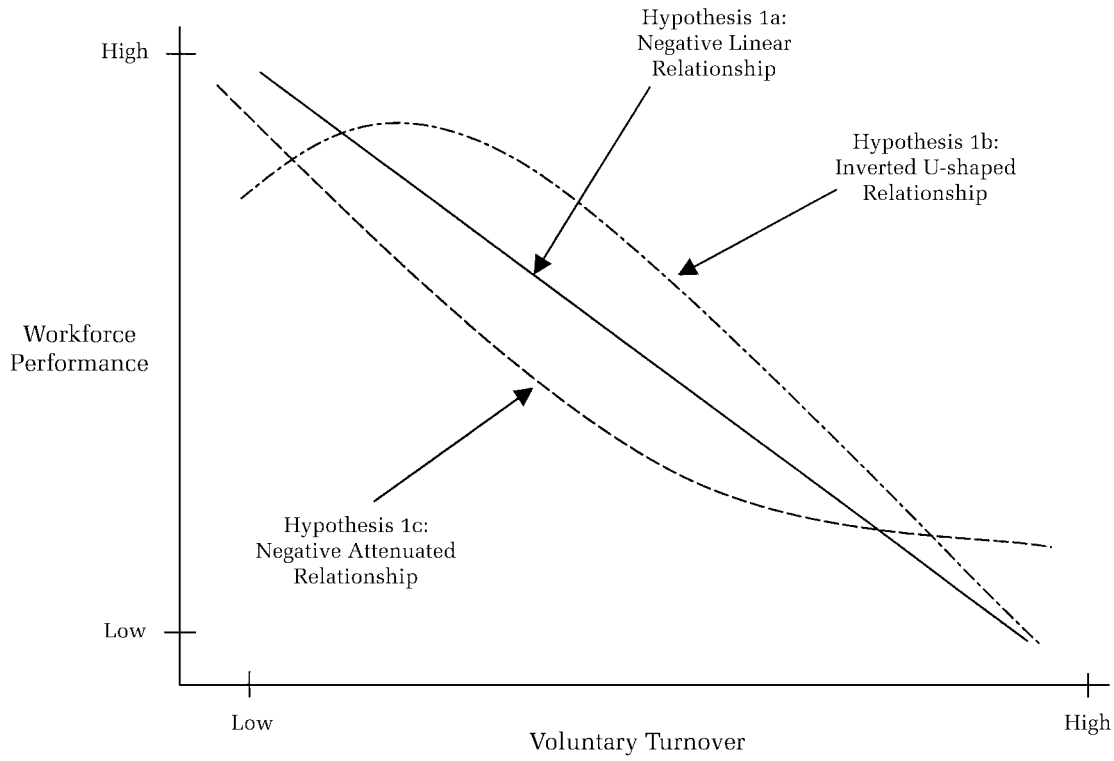
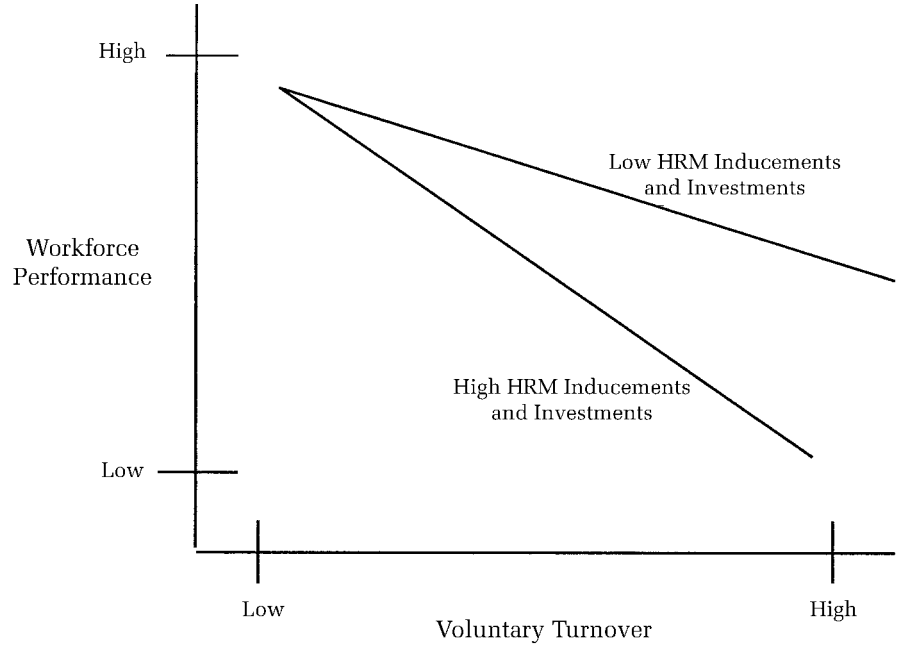


FIGURE 2
The HRM-Moderated Relationship of Voluntary Turnover and Workforce Performance



partially mediated by workforce performance. Stated formally:

Hypothesis 2a. The direct relationship between voluntary turnover and financial performance (a negative linear relationship, an inverted U-shaped relationship, or an attenuated negative relationship) is partially mediated by workforce performance.

Hypothesis 2b. The relationship between the interaction of voluntary turnover and HRM practices and financial performance is partially mediated by workforce performance.

STUDY 1: METHODS

Sample

This was a facility-level study of the 202 member plants of the American Concrete Pipe Association (ACPA) in the United States and Canada in 1995. After extensive prior contacts, plant managers were mailed a lengthy survey dealing with HRM, production and operations, and effectiveness. Completed responses from 141 facilities represented a 71 percent response rate. Missing data reduced the analysis sample to 110, or a 54 percent effective response rate. All measures referred to the core employee group, production employees. We took several steps to minimize error and to increase the reliability of key informant reports (Wright et al., 2001). We focused on a single industry, small establishments, and the core occupational group (production workers), defined as the largest group of nonmanagerial employees (Batt, 2002). We determined the most knowledgeable informant in each firm and instructed this individual to complete the survey or to have others complete sections for which they were more knowledgeable. We conducted extensive site visits to develop and pretest the measurement instruments and to identify language and phrasing unique to the industry. The test of our human capital hypotheses required a setting in which firm-specific human capital, rather than general skills, was important. Concrete pipe facilities are rare (there are typically one or two plants in a major U.S. metropolitan area), and the production of concrete pipe is vastly different and more complicated than the production of "ready-mix" concrete. As a result, the skills and abilities needed for high performance in the concrete pipe industry tend to be more sophisticated than those needed in other concrete facilities. They are also nontransferable, or firm-specific, because machines in concrete pipe plants are customized. The setting, then, appeared adequate for testing predictions based on human capital theory. The Appendix details all the substantive independent and dependent measures for Study 1.

Independent Variables

Voluntary turnover. Respondents provided information on the number of employees who quit in 1995 and the average number of production workers employed in 1995. The ratio of the two components formed the measure.

HRM inducement and investment index. The five HRM investments and inducements from the Shaw et al. (1998) framework (pay level, benefits level, job stability, training, and procedural justice) were used to form the index. Law, Wong, and Mobley (1998) referred to this type of measure as an aggregate from five dimensions. Each HRM practice is a separate dimension that causes the level of the composite, unlike in traditional scale scores, where the assumption is that the underlying conceptual variable causes scores on a measure. We combined the dimensions linearly since the components were assumed to be substitutable. For instance, inducements/investments would be equivalent in an organization offering high pay and high benefits only and in an organization offering high pay and high job stability only. These organizations would have the same level on the HRM index, both conceptually and operationally.

Pay level was measured as the average annual pay for production workers in a facility. *Benefits level* was the percentage of health insurance premiums paid by the company. *Job stability* consisted of the average of two items (α =.83; 1, "strongly disagree," 7, "strongly agree" for this and other investments and inducements items) regarding layoff prevalence; one of these was, "We give production workers other assignments during slow times." *Training* was the mean of six items assessing the extensiveness of training opportunities for production employees (α =.85). A sample item was, "We give our production employees extensive training." *Procedural justice* was assessed with three items (α =.64). A sample item was, "Our company has formal procedures to ensure that workers are treated fairly." The index standardized and averaged scores from the five measures. The reliability of the linear composite, found using the formula from Nunnally and Bernstein (1994), was .69.

Dependent Variables: Workforce Performance

A measure of financial performance was not available and, thus, only Hypotheses 1a–1d were tested here. Two measures of workforce performance were available. *Labor hour per ton* is a com-

mon productivity measure in heavy manufacturing (e.g., Arthur, 1994). It is the number of labor hours worked by production employees in a focal year divided by the tons of concrete products produced in the same year. We derived this measure from respondent reports by multiplying the number of production employees during average, peak, and slow months by the number of regular working hours in these months (assuming a 40-hour workweek). We then added in average number of overtime hours worked per employee during these periods. This total was then divided by the tons of concrete products produced. Fewer labor hours per ton indicates better performance. Key informant reports of labor hours per ton correspond well with archival measures (Arthur, 1994).

Our second performance measure, *accident rates,* is a common way of assessing workforce performance in the concrete pipe industry. This variable was measured as the number of "lost-time accidents" in the plant in the last five years divided by the number of production employees. A lower accident rate indicates better performance.

Control Variables

We drew on organization-level research on voluntary turnover (e.g., Alexander et al., 1994; Shaw et al., 1998) and strategic HRM (e.g., Arthur, 1994; Dean & Snell, 1991) in developing a set of control variables: facility size and age, corporate dependence, unionization, technology, and work interdependence. This set of controls was designed to account for factors shown to relate to voluntary turnover and performance across industries as well as for industry-specific factors that might be responsible for observed relationships. *Facility size* is related to administrative complexity, turnover, and productivity (e.g., Shaw et al., 1998). It was measured as the natural logarithm of the number of production workers in a plant. *Facility age* is a proxy for founding values and is related to voluntary turnover (e.g., Arthur, 1994). It was measured as 1995 minus the founding date of a facility. *Corporate dependence* can influence performance, voluntary turnover, and strategic alignment (Dean & Snell, 1991). Plants that were part of multiplant corporations were coded 1, and free-standing plants, 0. *Unionization* is related to HRM practices, voluntary turnover, and performance (Arthur, 1994; Freeman & Medoff, 1984; Shaw et al., 1998). This variable was coded 1 if production workers were covered by a collective bargaining agreement and 0 otherwise. We controlled for *machine automation,* which is an indicator of technological sophistication because a facility's physical equipment (packer-head and other dry-cast pipe-making machines in this case) may be associated with productivity and turnover rates (Arthur, 1994). Respondents rated each machine as having no automation (coded 1), partial automation (2), or full automation (3); the average automation level formed the measure. *Work interdependence* can also influence turnover and workforce performance. In concrete pipe production, sequential interdependence is a constant across plants. It is thus necessary to control for variations in interdependence beyond that required by constant sequential interdependence. Two controls were included. The first was a three-item scale (α = .78) capturing variations in the use of *advanced manufacturing technology;* that is, process technologies that increase integration and hence interdependence in a manufacturing process (Dean & Snell, 1991). The second control was a seven-item scale (α = .89) for the use of *work teams* (defined in the survey as "teams that cut across functions to work on quality issues") beyond that required by the production sequence. Another important control was initial labor quality (Osterman, 1987), as this variable can affect the relationship between turnover and performance. In our study, the HRM index was a proxy for the quality of a labor pool, in that facilities that invest more in pay, benefits, training, job security, and procedural justice should have higher initial labor quality than others (Arthur, 1994).

Analytic Approach

Hierarchical regression analyses were used to test the hypotheses (Cohen, Cohen, West, & Aiken, 2003). We computed regression equations by entering control variables in step 1, the HRM index and voluntary turnover in step 2 (the test of Hypothesis 1a), turnover squared in step 3 (the test of Hypotheses 1b and 1c), and the voluntary turnover by HRM index product term in the final step (the test of Hypothesis 1d). We standardized voluntary turnover before computing the squared and interaction terms to reduce nonessential multicollinearity (Cohen et al., 2003). Tests for violations of the assumptions of ordinary least squares (OLS) regression revealed no major violations in the equations.

STUDY 1: RESULTS

Table 1 shows the descriptive statistics for, and correlations among, all the variables in Study 1. Table 2 reports the regression analyses and tests of Hypotheses 1a–1d. The values in the table are unstandardized regression coefficients. For labor

hours per ton, Table 2 shows that the set of control variables ($\Delta R^2_{block} = .12$, $p < .05$) explained a significant amount of variance, but the second step, which included the HRM index and voluntary turnover, did not ($\Delta R^2_{block} = .01$, n.s.). The linear voluntary turnover term in step 2 was not significant and, thus, Hypothesis 1a was not supported. The third step, containing the quadratic turnover term, was significant ($b = -0.23$, $p < .01$) and explained an additional 4 percent of variance. To support Hypothesis 1b, productivity should increase as turnover increases initially, but it should be negative thereafter. To support Hypothesis 1c, the relationship should be negative and decelerate as voluntary turnover increases. Recall also that a sharply U-shaped relationship would not support Hypothesis 1c.

To understand this relationship, we used the equation from Cohen et al. (2003) to solve for the zero-slope point on the curve. The appropriate formula is $-(b_1 + b_4 \times HRM\ index)/(2 \times b_2)$, where b_1 is the coefficient for the linear turnover term and b_2 is the coefficient for the squared turnover term. This equation reduces to $-b_1/(2 \times b_2)$ or $-.79/(2 \times -.23)$ because the HRM index has a mean of zero. The predicted turning point of the curve was at 1.71 standard deviations (s.d.'s) from the mean, which represents voluntary turnover of approximately 55 percent. Figure 3 graphs this attenuated relationship. The relationship between voluntary turnover and workforce performance is sharply negative initially (recall that higher labor hours per ton indicates lower performance), but it is attenuated as turnover rises. To illustrate, we predicted an increase in labor hours per ton across facilities of 197 percent (from 0.45 to 1.34) as voluntary turnover increased from 0 percent to mean levels; an increase of only 41 percent from the mean to +1 s.d.; of 5 percent from +1 to +2 s.d.'s; a zero slope at +1.7 standard deviations. Thus, the relationship conforms to the prediction that "successively higher amounts of turnover will be found ultimately to produce, more often than not, *successively lower amounts of effectiveness at a decreasing rate*" (Price, 1977: 119; emphasis added) and supports Hypothesis 1c for labor hours per ton. No support was found for Hypothesis 1d, as the interaction of the HRM index and voluntary turnover did not predict labor hours per ton ($b = -0.19$, n.s.).

For accident rate, the control variables explained 9 percent of the variation (n.s.), and the second step, an additional 5 percent. The quadratic turnover term in step 3 was significant ($b = -0.04$, $p < .05$), explaining 4percent of the variance. Since the quadratic term provides a better fit, the significance of the linear term in step 2 does not support Hypothesis 1a. The turning point was 1.8 standard deviations from the mean. That is, the relationship between voluntary turnover and accident rate in this sample diminishes as turnover increases and falls to a zero slope at a turnover of 57 percent. A plot of this relationship, presented in Figure 4, shows that the predicted number of accidents per employee is .05 when the turnover rate is zero. The predicted rate is .21 accidents per employee at mean turnover levels (an increase of 340 percent). Accident rates increase by 49.9 percent from the mean to +1 s.d.'s, and only by 8 percent between +1 and +2 s.d.'s. The curve flattens at 1.82 s.d.'s and increases only slightly thereafter. Thus, Hypothesis 1c is supported in the equation for time lost to accidents. No support was found for Hypothesis 1d, as the interaction of the HRM index and voluntary turnover was not significant.

TABLE 1
Correlations and Descriptive Statistics for All Variables, Study 1

Variable	Mean	s.d.	*n*	1	2	3	4	5	6	7	8	9	10
1. Organization size	3.20	0.63	140										
2. Organization age	31.48	17.14	137	−.08									
3. Corporate dependence	0.87	0.34	140	−.16*	−.01								
4. Unionization	0.39	0.49	140	.24**	.01	.00							
5. Machine automation	1.65	0.54	140	.02	−.07	.13	.17						
6. Teams	3.24	1.20	139	.01	−.21**	.18*	.09	.15	(.89)				
7. Advanced manufacturing technology	1.73	1.17	139	.07	−.06	.04	.13	.11	.34*	(.78)			
8. HRM index	0.00	0.44	140	.16*	.08	−.05	.16*	.17	.19*	.09			
9. Voluntary turnover	0.17	0.22	120	−.08	−.11	.09	−.21*	−.13	.04	−.11	−.01		
10. Labor hours per ton	1.28	0.83	120	.11	−.05	−.08	.17	.02	.06	−.09	−.05	.05	
11. Accident rate	0.20	0.23	127	.01	−.01	−.19*	.19*	.06	−.21	−.01	−.18*	.02	.05

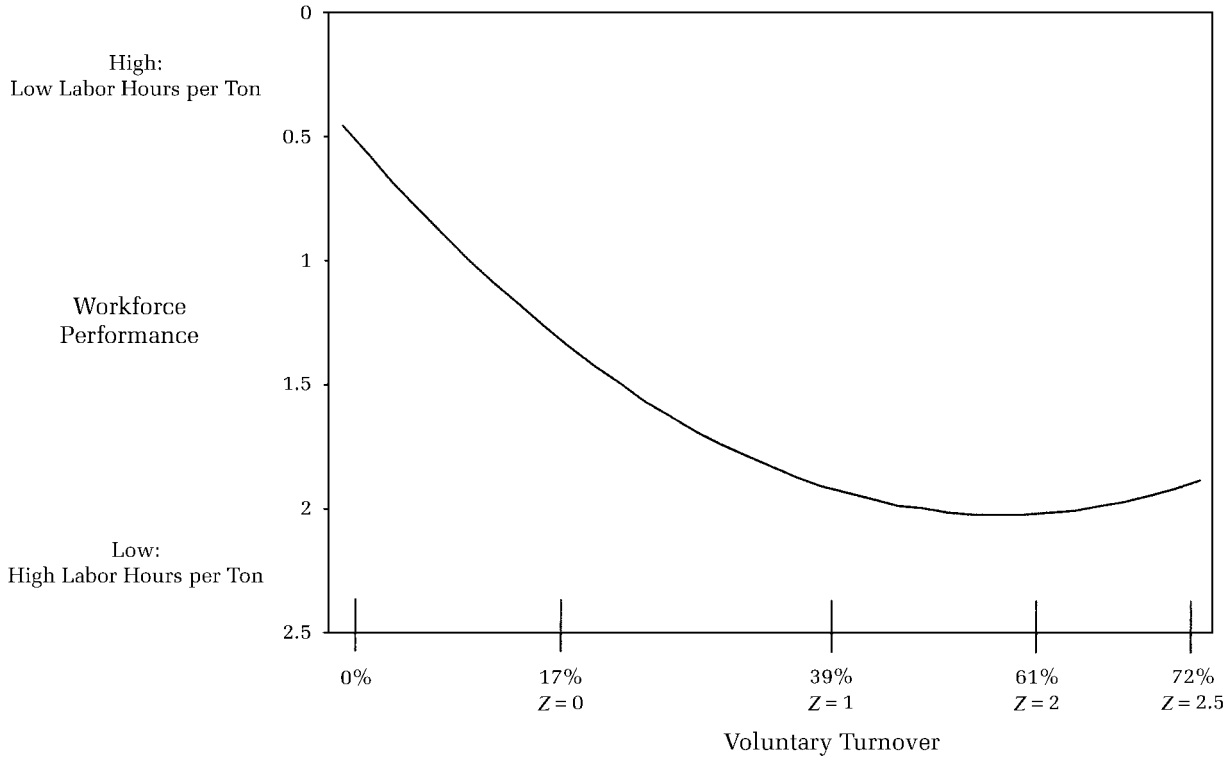
* $p < .05$
** $p < .01$

TABLE 2
Hierarchical Regression Analysis: Tests of Hypotheses 1a–1d, Study 1[a]

	Labor Hours per Ton				Accident Rate			
Variable	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Organization size	0.41	0.39	1.37	0.37	−0.03	−0.04	−0.03	−0.03
Organization age	−0.01	−0.01	−0.01	−0.01	0.00	0.01	0.00	0.00
Corporate dependence	1.28	1.28	1.17	1.16	−0.15*	−0.16**	−0.14**	−0.16**
Unionization	1.18*	1.19*	1.22*	1.22*	0.05	0.07*	0.08*	0.08*
Machine automation	−1.23	−1.23	−1.13	−1.14	0.06*	0.06*	0.07*	0.07*
Teams	−0.26*	−0.26*	−0.23*	−0.22*	−0.01	0.00	−0.02	0.01
Advanced manufacturing technology	−0.02	−0.04	−0.09	−0.07	−0.01	0.00	0.01	0.01
HRM index		−0.19	−0.25	−0.19		−0.06*	−0.07*	−0.06*
Voluntary turnover		0.08	0.79**	0.81**		0.12*	0.14**	0.12**
Voluntary turnover squared			−0.23**	−0.28**			−0.04**	−0.03**
Voluntary turnover × HRM index				−0.19				−0.04
ΔR^2, step	.12*	.01	.04**	.00	.09	.05*	.04*	.01
Total R^2	.12*	.13*	.17*	.17*	.09	.14*	.18**	.19**

[a] Unstandardized coefficients are reported. $n = 110$.
* $p < .05$
** $p < .01$

FIGURE 3
Study 1: Attenuated Negative Relationship between Voluntary Turnover and Workforce Performance in Predicting Labor Hours per Ton

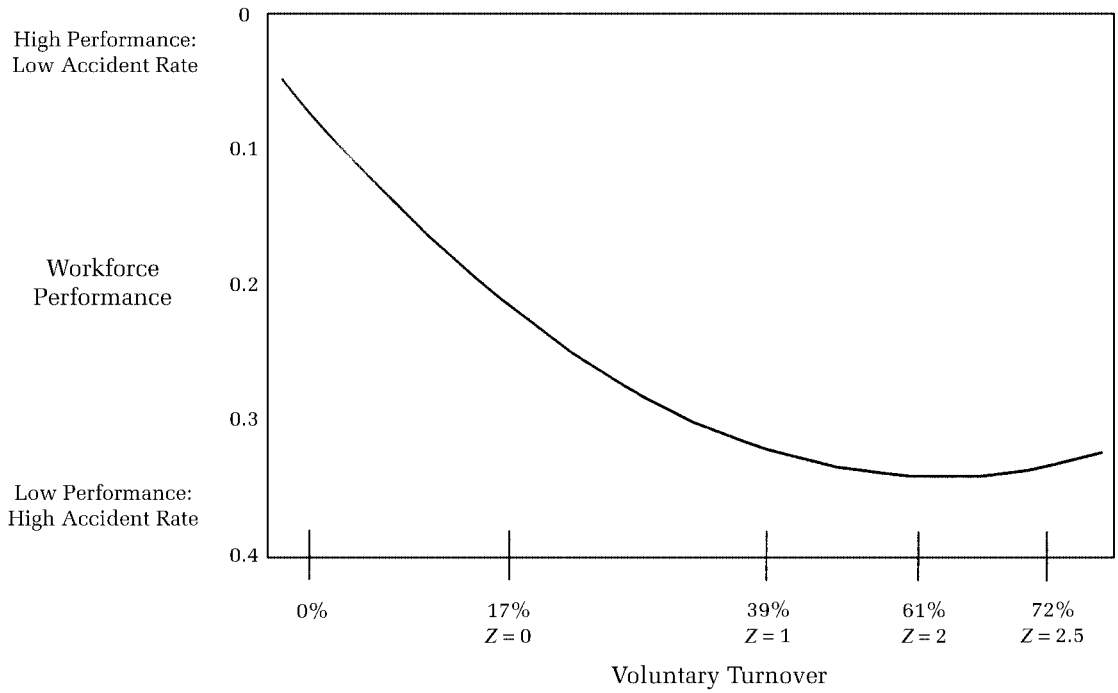


STUDY 2: METHODS

Sample and Data Sources

The sample included Class I (annual gross revenue of $10 million or more) and Class II ($3 to $10 million) trucking organizations included in the 1999 version of the *TTS Blue Book of Trucking Companies*. When companies that used owner-operators exclusively and those that had gone out of business after publication of the 1999 *Blue Book*

FIGURE 4
Study 1: Attenuated Negative Relationship between Voluntary Turnover and Workforce Performance in Predicting Accident Rate



were excluded, 1,041 companies remained. We mailed questionnaires after initial contact with an encouraging letter and a phone call. Nonrespondents were sent a second questionnaire six weeks later. Completed questionnaires were returned from 380 organizations, a response of 37 percent. Missing data reduced the analysis sample to 299, giving us an effective 29 percent response rate. We focused on a core occupational group (drivers), identified the managerial informant most knowledgeable about the drivers at each company, and conducted extensive site visits to develop and pretest the measurement instruments. As in Study 1, an adequate test of our human capital–based predictions required a setting in which firm-specific skills were important. In the trucking industry, drivers are hired with the requisite general skills (e.g., commercial licenses) and therefore typically acquire only firm-specific skills (e.g., operation of customized routing systems) after being hired. Thus, losses through voluntary turnover include not only the easily replaceable general skills, but also additional operational and administrative skills that are specific and important to the particular organization.

Two archival data sources were also used. The first was the *Blue Book,* which contains organizational and financial information that motor carriers file with the federal government. The second was the SAFER database, available on-line, which includes two-year running totals of accidents, inspection violations, and other information that motor carriers file with the Federal Highway Administration Office of Motor Carriers (FHWA). *Blue Book* information was obtained for the two years following questionnaire administration, 2000 and 2001. SAFER data were obtained to correspond precisely to this time frame (i.e., for 2000–01). The Appendix details all substantive independent and dependent measures for Study 2.

Measures: Independent Variables

Voluntary turnover. Respondents provided information on the number of company drivers who had quit in the past year and the average number of company drivers during the year. We calculated the ratio of quits to total drivers to represent voluntary turnover.

HRM inducement and investment index. The aggregated composite was assessed with the same five HRM practices we used in Study 1. *Pay level* was measured as the average annual pay for the typical driver in an organization. *Benefits level* was the percentage of health insurance premiums for drivers paid by a company. *Job stability* was the averaged response on two items (1, "strongly disagree," 7, "strongly agree"; $\alpha = .71$). One of the

items was, "We have systems in place to guarantee work for our drivers." *Training* was the mean number of hours per year that drivers were provided formal, organization-specific training in the following areas: computer skills, maintenance skills, and interpersonal skills. *Procedural justice* was assessed with five items (1, "strongly disagree," 7, "strongly agree"; $\alpha = .81$); an example item is, "Our company has formal procedures to ensure that drivers are treated fairly." The index was the average of the standardized scores from the five measures. The reliability for the composite, per Nunnally and Bernstein's (1994) formula, was .77.

Dependent Variables

Workforce performance. Three measures were used. The first, a common measure of productivity, was the amount of revenue generated per employee *(revenue per driver).* The numerator, the average gross freight revenue for 2000 and 2001, was obtained from the *Blue Book*. The denominator was the total number of drivers employed by an organization, as reported in the questionnaire. A second measure of workforce performance, *out-of-service percentage,* was obtained from SAFER for the two-year (2000–01) period. Motor carriers are subject to various random and regular inspections by federal and state transportation authorities. Violators of federal and state regulations pertaining to equipment or drivers (e.g., log book violations) are often removed from service until the violation is remedied. Our measure was specific to driver performance in the aggregate, showing the frequency of violations attributable to driver mistakes, and did not include factors beyond the drivers' control (e.g., poor equipment). This variable was assessed as the number of trucks or drivers taken out of service owing to driver fault, divided by the total number of inspections times 100. We calculated a third measure, *accident frequency ratio,* using information from the *Blue Book* and SAFER databases. This variable is defined as accidents per million miles driven. Total accidents for 2000–01 (SAFER) were divided by total miles driven for the same period *(Blue Book)* and multiplied by 1,000,000.

Financial performance. Two measures from the *Blue Book* were used. *Operating ratio* was defined as total operating expenses divided by total gross revenue times 100. *Return on equity (ROE)* indicates profit on invested capital and is often used in strategic HRM research (e.g., Delery & Doty, 1996). It is defined as net income divided by total equity. Both variables were calculated as the 2000 and 2001 calendar year average.

Control Variables

Our choice of control variables in Study 2 followed the same logic applied in Study 1; thus, we assessed variables related to voluntary turnover and performance in prior research (size, age, unionization), industry-specific confounds and technology (carrier type, tractor age, percentage of owner-operators), and social capital confounds (percentage of drivers in teams/relays). *Size* was the natural logarithm of the total number of employees, as reported by the respondent for a company; *age* was 2000 minus the founding year, as reported in the *Blue Book;* and *unionization* was the percentage of drivers covered by collective bargaining agreements, as reported by the respondent. Turnover and performance vary by industry segment (Shaw et al., 1998), and so we controlled for *carrier type,* measured as truckload and specialized commodity carriers (coded 1) and less-than-truckload (LTL) carriers (0). Average *tractor age* served as a proxy for technology. *Percentage of owner-operators,* included because their use may relate to turnover and revenues, was the percentage of total "line-hauls" and "over-the-road runs" completed by owner-operators. To account for the effects of interdependence and social capital losses, we controlled for the average *percentage of drivers who drive in teams and relays*.

Analysis

The tests of Hypotheses 1a–1d paralleled the approach used in Study 1. Hypotheses 2a–2b were tested using the mediation procedures outlined by Baron and Kenny (1986). The voluntary turnover variable was standardized prior to computation of the squared and interaction terms. Tests for violations of the assumptions of OLS regression analysis revealed no major violations in the equations.

STUDY 2: RESULTS

Response Bias Checks

We used data from the *Blue Book* and logistic regressions to compare the characteristics of responding and nonresponding organizations. We compared nonresponders (coded 0) to responders (coded 1) on an array of organizational and operating characteristics: carrier type, total fringe benefits cost, total highway miles driven, total wages paid, average haul (in miles), total insurance costs, current assets, company age, tons per mile, and average load (in tons). None of the independent variables were significant in this equation.

Regression Analyses

Table 3 shows correlations and descriptive statistics for the variables in Study 2. The results of the analyses for workforce performance (Hypotheses 1a–1d) are shown in Table 4.

Steps 2 and 3 of the regression equation contain the information for the tests of Hypotheses 1a–1d. In step 2, voluntary turnover was significantly and negatively related to revenue per driver ($b = -26.98$, $p < .05$), but the quadratic turnover term is also significant in step 3 ($b = 5.77$, $p < .01$; $\Delta R^2_{\text{block}} = .02$, $p < .01$). Thus, the relationship appears to be curvilinear, and Hypothesis 1a is not supported. A plot revealed a pattern consistent with Hypothesis 1c: the relationship between voluntary turnover and revenue per driver is negative but becomes attenuated as turnover increases. Using the same turning point formula applied in Study 1, we calculated the turning point on the equation to be 1.6 s.d.'s from the mean, or a rate of 102 percent. The predicted loss in revenue that will occur going from no voluntary turnover to the mean level of turnover is 10.6 percent ($21,000 per driver). The predicted loss going from mean voluntary turnover to one standard deviation above the mean is 7.1 percent (or $12,000 per driver), and the predicted loss as turnover moves from +1 to +2 standard deviations is less than 1 percent, or only $1,255 per driver. Thus, Hypothesis 1c is supported. The test of Hypothesis 1d is found in step 4. The product of voluntary turnover and the HRM index was not significant, and thus Hypothesis 1d was not supported.

For the accident frequency ratio, as Table 4 shows, the quadratic term in step 3 ($b = -0.08$, $p < .01$) was significant, explaining an additional 2 percent of the variance. The form was again supportive of Hypothesis 1c. The zero slope point was at a quit rate of +1.8 standard deviations, or an estimated rate of 110 percent. The predicted increase for the comparison between a company with no voluntary turnover and the mean organization is 63 percent; the increase from the mean to one standard deviation above the mean is 25 percent, and from +1 to +2 s.d.'s, the increase is only 5 percent. These results support Hypothesis 1c. The interaction of the HRM index and voluntary turnover was not significant, offering no support for Hypothesis 1d.

The third set of results in Table 4 concerns out-of-service percentage equations. Once again, the quadratic term on step 3 ($b = -0.85$, $p < .01$) was significant, explaining an additional 3 percent of variation in the equation beyond that explained by the controls and the linear term. The curvilinear relationship was consistent with Hypothesis 1c; performance declined, but at a diminishing rate, as turnover increased. The unstandardized coefficients yielded a turning point at a turnover of 2.4 standard deviations (132%) from the mean. Consistently with Hypothesis 1c, there is a predicted increase of 202.88 percent in the out-of-service percentage as turnover increases from none to the mean, and an increase of 49.6 percent in out-of-service as turnover goes one standard deviation higher. But as turnover increases from one to two standard deviations above the mean, there is only a 15.7 percent increase in the out-of-service percent-

TABLE 3
Correlations and Descriptive Statistics for All Variables, Study 2[a]

Variable	Mean	s.d.	*n*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Organization size	4.77	0.99	371													
2. Organization age	36.77	10.14	373	−.06												
3. Unionization	8.91	27.33	369	.01	.08											
4. Tractor age	3.69	2.76	364	.05	.05	.13*										
5. Carrier type	0.89	0.31	376	−.13**	.02	−.08	−.12*									
6. Percent relays/teams	10.05	24.13	368	.15**	−.12	−.03	−.07	−.06								
7. Owner-operator percentage	21.15	27.24	373	−.17**	.04	−.13**	.05	.09	−.16**							
8. HRM index	0.00	0.69	373	.08	.09	.19**	−.08	−.08	.10	−.24**						
9. Voluntary turnover	0.41	0.38	356	.16**	−.12*	−.18**	−.08	.21**	.07	.14*	−.33**					
10. Revenue per driver	180.34	127.39	325	−.22**	.14*	.01	.02	.12*	−.12*	.46**	−.03	.06				
11. Accident frequency ratio	0.47	0.40	347	−.03	−.09	−.01	.05	−.07	.20**	.07	−.11*	.09	−.06			
12. Out-of-service percentage	6.64	5.01	375	−.05	.02	−.14*	−.13*	.19*	.12*	.11*	.07	.30**	−.07	.06		
13. Operating ratio	98.31	4.74	325	−.14*	.01	.14*	.08	−.05	−.05	−.03	−.02	.08	.09	.08	.19**	
14. Return on equity	2.19	10.93	325	.05	.00	−.03	−.03	.10	.08	.16**	.08	.12*	.10	−.02	−.13*	−.54**

[a] Revenue per driver is reported in thousands.
* $p < .05$
** $p < .01$

TABLE 4
Hierarchical Regression Analyses with Workforce Performance Measures as Dependent Variables: Tests of Hypotheses 1a–1d, Study 2[a]

	Revenue per Driver				Accident Frequency Ratio				Out-of-Service Percentage			
Variable	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Organization size	−21.61	−23.51	−20.33	−21.93	0.01	−0.01	−0.01	0.01	−0.13**	−0.15**	−0.27**	−0.28**
Organization age	−0.03**	−0.03**	−0.03**	−0.04**	0.01	0.01	0.01	0.01	−0.02	−0.06	−0.01	−0.02
Unionization	0.28	0.28	0.19	0.18	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.01	−0.01
Tractor age	1.02	1.45	0.47	0.43	0.01	0.01	0.01	0.01	−0.18*	−0.16*	−0.13*	−0.13
Carrier type	7.67	0.45	9.78	10.96	−0.12*	−0.16*	−0.18**	−0.18*	3.18**	2.53**	2.16**	2.16**
Percent relays/teams	−0.15	0.24	−0.20	−0.25	−0.01**	−0.01**	−0.01**	−0.01**	0.03**	0.03**	0.03**	0.03**
Owner-operator percentage	2.25**	2.19**	2.12**	2.09**	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
HRM index		23.33	13.16	11.87		0.01	0.02	0.03		0.37	0.77	0.74
Voluntary turnover		−26.98	−18.57	−22.53		0.14*	0.28**	0.28**		2.61**	4.09**	4.92**
Voluntary turnover squared			5.77**	13.05**			−0.08**	−0.07*			−0.85**	−0.86**
Voluntary turnover × HRM index				−17.03				0.02				−0.13
ΔR^2, step	.27**	.02*	.02**	.01	.06*	.02*	.02**	.00	.13**	.04**	.03**	.00
Total R^2	.27**	.29**	.31**	.32**	.06*	.08*	.10**	.10**	.13**	.17**	.20**	.20**

[a] Unstandardized coefficients are reported. $n = 299$.
* $p < .05$
** $p < .01$

age. The interaction of voluntary turnover and the HRM index was not significant in predicting the out-of-service percentage.

Hypothesis 2a concerns whether workforce performance mediates the relationship between voluntary turnover and financial performance, and Hypothesis 2b concerns whether workforce performance mediates the interaction of HRM inducements and investments, voluntary turnover, and financial performance. We tested these possibilities using the steps outlined by Baron and Kenny (1986). Four conditions must be met for mediation to be established here: (1) Voluntary turnover (Hypothesis 2a) or the interaction of the HRM index and voluntary turnover (Hypothesis 2b) must be related to the mediating variables; this was established only for the attenuated negative relationship for all three workforce performance outcomes (Table 4). (2) The workforce performance mediators and financial performance outcomes must be related. (3) Voluntary turnover must be related to financial performance. (4) The effect of voluntary turnover on financial performance should fall to zero (full mediation) or be reduced (partial mediation) when mediators are entered.

As noted, the first step in the process was established with the results reported in Table 4. We calculated partial correlations between the variables for workforce performance and financial performance to address the second step. Holding constant the set of controls, we found that neither revenue per driver (partial $r = -.03$, n.s.) nor the accident frequency ratio (partial $r = .09$, n.s.) was related to the operating ratio, but the out-of-service percentage was significantly and positively related (partial $r = .18$, $p < .01$). The same pattern emerged for ROE. The out-of-service percentage was significantly related (partial $r = -.13$, $p < .01$) to voluntary turnover, but no significant relationships were found for revenue per driver (partial $r = .03$, n.s.) or the accident frequency ratio (partial $r = -.02$, n.s.). Thus, according to the Baron and Kenny (1986) guidelines, only the out-of-service percentage was a potential mediator between voluntary turnover and financial performance, and only the third and fourth steps were pursued for this measure.

Table 5 shows the results of the mediated regression analysis. To address the third criterion, we regressed the operating ratio and ROE on the independent variables. For the negative attenuated effect to be mediated by the out-of-service percentage, the quadratic turnover term should be significantly related to the financial performance outcomes but should be reduced when the out-of-service percentage is entered. Step 3 shows that the quadratic term is significant ($b = -0.25$, $p < .01$) in a direction consistent with the floor effect hypothesis. Supporting Hypothesis 2a (see step 5 for the operating ratio in Table 5), the relationship between the out-of-service percentage and the oper-

TABLE 5
Hierarchical Regression Analyses for Financial Performance Hypotheses and Mediation Tests, Hypotheses 2a–2b, Study 2[a]

	Operating Ratio					Return on Equity				
Variable	Step 1	Step 2	Step 3	Step 4	Step 5	Step 1	Step 2	Step 3	Step 4	Step 5
Organization size	−0.84**	−0.87**	−0.96**	−0.93**	−0.85**	3.57*	3.62*	3.34*	3.36**	2.83*
Organization age	0.28	0.30	0.31	0.34	0.42*	−1.35	−1.52	−1.50	−1.85	−2.51*
Unionization	0.01	0.01	0.01	0.02	0.02	−0.04	−0.04	−0.03	−0.03	−0.04
Tractor age	0.12	0.11	0.14	0.16	0.17	0.38	0.35	0.47	0.38	0.25
Carrier type	−1.70*	−1.88*	−2.09**	−2.12**	−2.33**	10.85*	10.42*	9.89*	10.56*	12.11**
Percent relays/teams	−0.01	−0.01	−0.01	−0.01	−0.01	0.18**	0.18**	0.18**	0.16**	0.18**
Owner-operator percentage	0.01	0.00	0.01	0.01	0.01	0.11*	0.10*	0.10*	0.10*	0.11*
HRM index		−0.12	−0.10	−0.11	−0.03		4.25	3.62	4.19	3.63
Voluntary turnover		0.64	1.89**	1.93**	1.31		−0.41	3.31	3.49	4.04
Voluntary turnover squared			−0.25**	−0.20**	−0.11			−0.69	−1.34	−1.96
Voluntary turnover × HRM index				0.38	0.40				−4.24*	−4.56*
Out-of-service percentage					0.14**					−1.03**
ΔR^2, step	.06**	.00	.02*	.00	.02**	.07**	.01	.00	.01*	.03**
Total R^2	.06**	.06*	.07**	.07**	.09**	.07**	.08**	.08**	.09**	.12**

[a] Standardized coefficients are reported. $n = 299$.
* $p < .05$
** $p < .01$

ating ratio is significant ($b = 0.14$, $p < .01$), and the relationship between the quadratic turnover term and the operating ratio falls to nonsignificance when the out-of-service percentage enters the equation ($b = -0.11$, n.s.). The Sobel test (see Baron & Kenny, 1986) revealed that the reduction was significant at the .05 level. Thus, Hypothesis 2a, positing mediation by the out-of-service percentage in the operating ratio equation, receives some support.

The results for ROE are shown on the right side of Table 5. In these equations, there is no significant direct relationship between voluntary turnover and ROE, although the voluntary turnover and HRM index interaction is significant ($b = -4.24$, $p < .05$). The pattern, when plotted, is such that the relationship between voluntary turnover and ROE is significant and negative when the HRM index is high, but nonsignificant when the HRM index is low. Although the out-of-service percentage is also related to ROE ($b = -1.03$, $p < .01$), no mediation is evident, as the interaction did not relate to the out-of-service percentage. Thus, no support was found for Hypotheses 2a and 2b in the ROE equation.

DISCUSSION

In these studies, we tried to begin unraveling the "black box dynamics" of interaction among organizational turnover, HRM, and organizational performance. We found that voluntary turnover was significantly related to workforce performance levels, but not in a simple linear fashion. Rather, across five dependent variables and two industrial settings, we found that the negative effects of voluntary turnover on workforce performance were attenuated as voluntary turnover rates rose. We also found some support for the argument that workforce performance mediated the relationship of voluntary turnover and financial performance. The results are useful because they distinguish among alternative theoretical variations of human capital theory (Platt, 1964), focus on key blue-collar employees in two industries, involve a variety of data sources, and involve data obtained over time. Our results and their implications for science and practice are discussed below.

We tested four variations of human capital theory arguments regarding the relationship between voluntary turnover and workforce performance: that the relationship is negative and linear; that it has an inverted U-shape; that it is negative but attenuated at higher voluntary turnover rates; and that it is moderated by HRM practices. The results consistently support a curvilinear pattern in which the effects of turnover on workforce performance are very strong when turnover is low but weaken as turnover increases. As human capital theory suggests, quits indeed deprive an organization of the skills and abilities necessary for high performance among the workforce, but beyond a certain point, increases in quit rates are not incrementally erosive. That is, since average firm-specific human

capital accumulations diminish as voluntary turnover increases, the incremental effect of turnover on workforce performance is less severe. Compared to the curvilinear formulation supported in these studies, a linear formulation would *underestimate* the relationship with workforce performance as voluntary turnover increases from low to mean levels, but *overestimate* the negative effects as rates increase beyond mean levels. Our results in terms of productivity, accident rates, and revenue also reveal the significant, practical implications of this distinction.

In our research, Hypothesis 1a (linear negative relationship) was circumscribed by the results, but Hypotheses 1b (inverted U) and 1d (moderated) were not supported. Dalton and Todor's (1979) formulation has received little empirical support in the literature. A rare exception is the work of Glebbeek and Bax (2004), who found an inverted U-shaped relationship among units of a single organization. There are various explanations for the inconsistency between Glebbeek and Bax's results and those of our study and prior research in general. One, of course, is that the former is a single-organization study, not necessarily applicable to our cross-organization design. A second explanation lies in the nature of the measures used. For their measure of turnover, Glebbeek and Bax used the number of leavers during a year divided by the average number of workers an organization had during that same year. This variable presumably measures total turnover, which combines quits and discharges. Taking the view that quits and discharges can be distinct phenomena (Shaw et al., 1998), we focused on quits exclusively. Another explanation is the potential situation-specificity of the Dalton and Todor (1979) and Abelson and Baysinger (1984) formulations. The human capital issues—trained incapacity and stagnation—underlying the inverted-U proposition may be more relevant at some locations in an organization than others. For instance, these issues may be relevant among top managers who are responsible for strategic direction and decisions involving environmental risk, but not among blue-collar production workers. Stagnation and trained incapacity may also be more germane for knowledge-based workers than for drivers and production workers doing more predictable activities. Our data precluded a test of situation-specificity, but this explanation merits further exploration.

Another variation of human capital theory to receive no support was that HRM inducements and investments moderate the relationship of quit rates and workforce performance, a general proposition that has been supported in other research (Arthur, 1994; Guthrie, 2001). Perhaps, again, the difference in the measures used in the cited work and the current study—total turnover versus quits—explains these differences. Another possibility is that a quadratic relationship was evident, but not tested, in the cited studies. Cohen and his coauthors showed that when a true relationship is curvilinear and a linear interaction with moderately to highly correlated cross-product terms is "mistakenly estimated in the sample, a significant interaction can potentially be detected" (2003: 299). A third explanation is that our HRM index, which was patterned after Shaw and colleagues (1998), incorporated variables predictive of retention, not financial performance. This index should overlap with that measuring high-performance work practices (Delery & Doty, 1996), but an index specifically designed to capture high-performance work practices might have fared better. We hope that future research disentangles whether the discrepancies between previous research and ours are substantive or artifactual.

We investigated whether workforce performance mediated the relationship of voluntary turnover and financial performance in Study 2 with two measures of financial performance: operating ratio and return on equity. There was, at best, limited support for the mediation argument. We detected no mediation with respect to ROE but found some support with respect to the out-of-service percentage mediating the relationship of voluntary turnover and the operating ratio. Full rather than partial mediation was evident. In many ways, even this limited support is encouraging, because complex higher-order effects are difficult to detect in general, and this difficulty is compounded when a more elaborate mediation model is involved. That we observed a floor-effect curvilinear relationship between voluntary turnover and a financial performance outcome (operating ratio) that was mediated by the out-of-service percentage perhaps implies the presence of a strong underlying effect. On the other hand, that the effects were not evident across all measures of work performance and financial performance could imply that the support is serendipitous and data-specific.

Taken together, the results raise many interesting possibilities for further work on these issues, and they point to some cautions and constraints as well. The discovery of this particular curvilinear relationship between voluntary turnover and workforce performance highlights the importance of examining nonlinear and nonadditive functions in exploring human resources management and organizational effectiveness. It would be useful to replicate this curvilinear function in different sam-

ples and to incorporate a broader array of dysfunctional employee behaviors (e.g., absenteeism, tardiness, substance use). Further, although Dalton and Todor's (1979) general propositions were not supported here, it is still important to study functional/dysfunctional turnover issues systematically at the organizational level. Is turnover higher among better performers than among poorer performers? High performance signifies more human capital; strong performers are also likely to have better alternative employment opportunities. In individual-level research, the relationship between performance levels and decisions to quit has typically had an inverted U-shape—that is, both strong performers and poor performers decide to quit more frequently than do average performers (e.g.,Trevor, Gerhart, & Boudreau, 1997; Williams & Livingstone, 1994)—but such patterns at the organizational level must be determined. The three-way dynamics of HRM practices, quit rates, and employee performance also need study. As an anonymous reviewer pointed out, individual pay-for-performance programs, if implemented and administered appropriately, should reduce quitting among good performers but should increase it among poor (and, possibly, among average) performers. Shaw and Gupta (2002) reported some support for these relationships, but only when pay was highly dispersed across employees and when information about their organization's pay-for-performance system was communicated well to them. But it is not known whether similar patterns play out for various HRM practices. The central focus of our study was human capital issues, but turnover also results in loss of social capital. Our investigations entailed settings in which social capital variations are minimal, making social capital issues less relevant. The dynamics of social capital and its impact on performance and turnover have been elucidated conceptually (e.g., Adler & Kwon, 2002; Dess & Shaw, 2001) and tested empirically in a recent study (Shaw, Duffy, Johnson, & Lockhart, 2003), but further empirical work in settings with rich social capital is essential.

Our results must be viewed in light of some limitations. Study 1 involved cross-sectional data from a single source, an organizational key informant, highlighting issues of common method variance, response consistency, informant accuracy or reliability, and causal reciprocity. The reliability of key informant reports is the subject of much debate (Wright et al., 2001), and despite our efforts to reduce problems, the results should be interpreted with caution. Even in Study 2, where there was temporal lag, reverse causality or reciprocal effects are of potential concern. It may be that high workforce and financial performance are manifested in lower voluntary turnover rates—people are less likely to quit better, more productive organizations. Better-performing organizations may offer better working conditions, a share in profits, and/or a more satisfying performance-oriented culture that result in lower turnover. Thus, although our theory suggests a certain causal pattern, we cannot rule out the possibility of reverse or reciprocation causation. Some support for our causal logic is found in Glebbeek and Bax (2004), where significant associations were found only when turnover measures preceded performance measures. The authors concluded that performance "may indeed be seen as being influenced by turnover and not the cause of turnover" (Glebbeek & Bax, 2004: 15). Future research should develop stronger research designs able to tease out potential reciprocal effects. Our study was confined to two industries and two key jobs, raising generalizability concerns. Although our results can be generalized cautiously to blue-collar or skilled-trade settings where interdependence is low, the specific turnover-performance relationship may be affected by requisite skill levels, learning curves, and more. Even if an attenuated negative relationship were widely observed across settings, the rate of attenuation may vary with interdependence, social capital, skill dictates, or other factors. The alternative hypotheses were generally based on variations of human capital theory, which requires a consideration of the firm-specificity of skills. We argued that firm-specific skills were relevant in both industries but had no direct information on the balance of general and firm-specific skills in the sample. The results in both studies belie the argument that only general skills are lost through turnover, because human capital theory would predict a nonsignificant relationship between turnover and performance under these conditions. Despite this result, we encourage future researchers to try to replicate our findings in different industrial contexts or to include direct assessments of general and firm-specific skill losses from employee quits. Finally, our results may be explained by unmeasured variables (e.g., absence rates, workforce age; [Glebbeek & Bax, 2004]) or other confounds. We used controls commonly found in the turnover and strategic HRM literature as well as a set of industry-, technology-, and social capital–based controls, but other, unmeasured factors may have biased our results.

Offsetting these concerns are certain methodological elements here: we focused on higher-order effects, which are less subject to common method explanations than other effects, and we replicated the workforce performance results in Study 2 with

data from archival sources and time-lagged dependent variables. In terms of generalizability, strong and consistent results were obtained across two studies, two different types of performance measures, and two key employee groups. The support across two settings speaks to the robustness of our results. Some cautious generalizations to other blue-collar settings where human capital accumulations are deemed important are probably warranted. Data in Study 2 were obtained from key informants and two distinct archival sources, eliminating concerns about common method variance while confirming results from Study 1. Other aspects of our design also bolster confidence in the substance of the results. This was an organization-level analysis of a large sample of companies in one industry (trucking) and of a sample that included more than half of the total population of plants in another (concrete pipe). We held the focal job constant in both studies and controlled for factors that can contaminate observed relationships.

Perhaps the major contribution of this study is that, following Platt (1964), we pitted predictions from four alternative variations of the same theme (human capital theory) and examined these empirically. We hope future research adopts this approach more frequently in resolving theoretical conflicts. The resulting consistent curvilinear pattern validates a variation on human capital theory arguments initially proposed by Price (1977). There was also limited support for the argument that workforce performance mediates the relationship between quit rates and financial performance. This study thus moves research toward a better understanding of voluntary turnover–performance dynamics.

REFERENCES

Abelson, M. A., & Baysinger, B. D. 1984. Optimal and dysfunctional turnover: Toward an organizational level model. ***Academy of Management Review,*** 9: 331–341.

Adler, P. S., & Kwon, S- W. 2002. Social capital: Prospects for a new concept. ***Academy of Management Review,*** 27: 17–40.

Alexander, J. A., Bloom, J. R., & Nuchols, B. A. 1994. Nursing turnover and hospital efficiency: An organizational-level analysis. ***Industrial Relations,*** 33: 505–520.

Arthur, J. B. 1994. Effects of human resource management systems on manufacturing performance and turnover. ***Academy of Management Journal,*** 37: 670–687.

Baron, R. M., & Kenny, D. A. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. ***Journal of Personality and Social Psychology,*** 51: 1173–1182.

Batt, R. 2002. Managing customer service: Human resource practices, quit rates, and sales growth. ***Academy of Management Journal,*** 45: 587–597.

Becker, B., & Gerhart, B. 1996. The impact of human resource management on organizational performance: Progress and prospects. ***Academy of Management Journal,*** 39: 779–801.

Brown, C., & Medoff, J. 1978. Trade unions in the production process. ***Journal of Political Economy,*** 86: 355–378.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. 2003. ***Applied multiple regression/correlation analysis for the behavioral sciences*** (3rd ed.). Mahwah, NJ: Erlbaum.

Dalton, D. R., & Todor, W. D. 1979. Turnover turned over: An expanded and positive perspective. ***Academy of Management Review,*** 4: 225–235.

Dean, J.W., & Snell, S. A. 1991. Integrated manufacturing and job design: Moderating effects of organizational inertia. ***Academy of Management Journal,*** 34: 776–804.

Delery, J. E., & Doty, D. H. 1996. Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions. ***Academy of Management Journal,*** 39: 802–835.

Delery, J. E., & Shaw, J. D. 2001. The strategic management of people in work organizations: Review, synthesis, and extension. In G. Ferris (Ed.), ***Research in personnel and human resources management,*** vol. 20: 165–198. Greenwich, CT: JAI Press.

Dess, G. G., & Shaw, J. D. 2001. Voluntary turnover, social capital, and organizational performance. ***Academy of Management Review,*** 26: 446–456.

Dubin, R. 1970. Management in Britain—Impression of a visiting professor. ***Journal of Management Studies,*** 7: 183–198.

Freeman, R. B., & Medoff, J. L. 1984. ***What do unions do?*** New York: Basic Books.

Glebeek, A. C., & Bax. E. H. 2004. Is high employee turnover really harmful? An empirical test using company records. ***Academy of Management Journal,*** 47: 277–286.

Guthrie, J. P. 2001. High-involvement work practices, turnover, and productivity: Evidence from New Zealand. ***Academy of Management Journal,*** 44: 180–196.

Huselid, M. A. 1995. The impact of human resource management practices on turnover, productivity, and corporate financial performance. ***Academy of Management Journal,*** 38: 635–672.

Kacmar, K. M., Andrews, M. C., Van Rooy, D., Steilberg,

C., & Cerrone, S. 2004. ***Sure everyone can be replaced. . .but at what cost? Turnover as a predictor of unit-level performance.*** Paper presented at the Southern Management Association meeting, San Antonio.

Law, K. S., Wong, C., & Mobley, W. H. 1998. Toward a taxonomy of multidimensional constructs. ***Academy of Management Review,*** 23: 741–755.

Logan, G. D. 1992. Shapes of reaction-time distributions and shapes of learning curves: A test of the instance theory of automaticity. ***Journal of Experimental Psychology,*** 18: 883–914.

McElroy, J. C., Morrow, P. C., & Rude, S. C. 2001. Turnover and organizational performance: A comparative analysis of voluntary, involuntary, and reduction-in-force turnover. ***Journal of Applied Psychology,*** 86: 1294–1299.

Nunnally, J. C., & Bernstein, I. H. 1994. ***Psychometric theory*** (3rd ed.). New York: McGraw-Hill.

Ohlsson, S. 1996. Learning from performance errors. ***Psychological Review,*** 103: 241–262.

Osterman, P. 1987. Turnover, employment security, and the performance of the firm. In M. Kleiner (Ed.), ***Human resources and the performance of the firm:*** 275–317. Madison, WI: Industrial Relations Research Association.

Pencavel, J. 1972. Wages, specific training, and labor turnover in U.S. manufacturing industries. ***International Economic Review,*** 13: 53–64.

Platt, J. R. 1964. Strong inference. ***Science,*** 146: 347–353.

Price, J. L. 1977. ***The study of turnover.*** Ames: Iowa State University Press.

Shaw, J. D., Delery, J. E., Jenkins, G. D.,, & Gupta, N. 1998. An organizational-level analysis of voluntary and involuntary turnover. ***Academy of Management Journal,*** 41: 511–525.

Shaw, J. D., Duffy, M. K., Johnson, J. J., & Lockhart, D. 2003. ***Turnover, social capital, and performance: A facility-level analysis.*** Paper presented at the annual meeting of the Academy of Management, Seattle.

Shaw, J. D., & Gupta, N. 2002. ***Does money make good employees leave? Organizational pay decisions, performance, and employee quit patterns.*** Paper presented at the 2001 conference of the Southern Management Association, New Orleans.

Staw, B. M. 1980. The consequences of turnover. ***Journal of Occupational Behavior,*** 1: 253–273.

Strober, M. H. 1990. Human capital theory: Implications for HR managers. ***Industrial Relations,*** 29: 214–239.

Trevor, C.O., Gerhart, B., & Boudreau, J. W. 1997. Voluntary turnover and job performance: Curvilinearity and the moderating effects of salary growth and promotions. ***Journal of Applied Psychology,*** 82: 42–61.

Williams, C. R., & Livingstone, L. P. 1994. Another look at the relationship between performance and voluntary turnover. ***Academy of Management Journal,*** 37: 269–298.

Wright, P. M., Gardner, T. M., Moynihan, L.M., Park, H. J., Gerhart, B., & Delery, J. E. 2001. Measurement error in research on human resource management and firm performance: Additional data and suggestions for future research. ***Personnel Psychology,*** 54: 875–901.

APPENDIX

List of Measures

Study 1

Data for all the following measures were obtained from a questionnaire.

Voluntary Turnover

The number of production employees who quit in 1995 divided by the average number of production employees.

HRM Inducement and Investment Index

Pay level: The average hourly rate for production employees times 2000.

Benefits level: The percent of health insurance premiums paid by the company.

Job stability: We give production workers other assignments during slow times.

We lay production workers off when business is slow (reversed)

Training: We give our production employees extensive training.

We keep track of how effective our training programs are.

Each production employees must go through formal training from time to time.

Our employees get a lot of training after we hire them.

We measure how well our training programs work.

We continue to train our employees for as long as they work for us.

Procedural justice: Our company has formal procedures to ensure that our workers are treated fairly.

We rule on disputes only after we investigate all sides of the issue thoroughly.

Production employees have a chance to answer any complaints made against them.

Labor Hours per Ton

The number of labor hours worked by production employees in 1995 divided by the tons of concrete products produced.

Accident Rate

The number of lost-time accidents in the last five years divided by the average number of production employees.

Study 2

The source of each variable appears in parentheses after its description.

Voluntary Turnover

The number of drivers who quit in the past year divided by the average number of drivers. (questionnaire)

HRM Inducement and Investment Index

All data were from the questionnaire.

Pay level: The average annual pay for a typical driver.
Benefits level: The percent of driver health insurance premiums paid by the company.
Job stability: We guarantee our drivers a certain amount of work in every pay period.

We have systems in place to guarantee work for our drivers.

Training: About how many hours of formal training does a typical driver receive each year in the following areas? (computer skills, maintenance skills, interpersonal skills)

Procedural justice: We have formal systems in place to ensure that our drivers are treated fairly.

Drivers can always give "their side of the story" when complaints are made about their driving performance.

Drivers always have a chance to answer any complaint against them.

Management always asks for drivers' opinions before making decisions that affect them.

We rule on disputes about drivers only after investigating the issue thoroughly.

Formal procedures are in place to address any driver grievances.

Revenue per Driver

Average of gross freight revenue for 2000 and 2001 *(Blue Book)* divided by the total number of drivers.

Out-of-Service Percentage

The number of trucks/drivers taken out of service in 2000 and 2001 after inspection divided by the total number of inspections. (SAFER)

Accident Frequency Ratio

Total accidents for 2000 and 2001 (SAFER) divided by total miles driven for 2000 and 2001 *(Blue Book)* times 1,000,000.

Operating Ratio

Total operating expenses divided by total gross revenue times 100 (average of 2000 and 2001; *Blue Book*)

Return on Equity

Net income divided by total equity (average of 2000 and 2001; *Blue Book*)

Jason D. Shaw *(jdshaw@uky.edu)* is an associate professor and the Clark Material Handling Company Professor of Management in the Gatton College of Business and Economics at the University of Kentucky. He received his Ph.D. in management from the University of Arkansas. His research interests include individual and organizational consequences of compensation decisions, voluntary and involuntary turnover, and person-environment congruence issues.

Nina Gupta is a professor and the Raymond F. Orr Chair of Management in the Sam M. Walton College of Business at the University of Arkansas. She received her Ph.D. in organizational psychology from the University of Michigan. Her research interests include compensation and reward systems, employee and organizational turnover, and the effects of organizational policies on human resources.

John E. Delery is an associate professor of management in the Sam M. Walton College of Business at the University of Arkansas. He received his Ph.D. in management from Texas A&M University. His research interests include the strategic management of human resources, the structure of employment systems, and employee selection.