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Organizational Commitment, Job Involvement, and Turnover: A Substantive and Methodological Analysis

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This study was conducted to examine the hypothesis that organizational commitment and job involvement interact in the prediction of turnover (Blau & Boal, 1987). Prior work in this area has not incorporated a sufficiently broad definition of commitment, has omitted relevant covariates, and has utilized inappropriate estimation procedures (ordinary least-squares regression [OLS]). The presence of a commitment–involvement interaction was tested in three estimation models with data obtained from 138 supervisors. Models estimated with OLS replicated prior work (Blau & Boal, 1989) irrespective of whether additional covariates were included. Identical models estimated with logistic regression provided no support for the presence of a commitment–involvement interaction. It is concluded that results obtained with linear techniques are a function of an inappropriate estimation procedure when the dependent variable is binary. The potential impact of the widespread use of linear estimation procedures in turnover research is discussed.

Organizational commitment and job involvement have been major themes in the organizational literature, especially with regard to the prediction of organizational outcomes, such as turnover. In fact, it is the potential influence of these variables on turnover that represents a particular methodological challenge for this line of research, namely the estimation of statistical models with binary dependent variables. In this article, we report the results of a study that extends prior work on organizational commitment, job involvement, and turnover, and we illustrate how the use of inappropriate estimation procedures raises significant questions about the validity of earlier research. The focus of this study, therefore, was twofold: one substantive, the other methodological. The substantive research question considered was a test of Blau and Boal's (1987) hypothesis that organizational commitment and job involvement interact to influence turnover. The methodological issue (that nonlinear logistic regression is the appropriate estimation procedure for models with dichotomous dependent variables) is applicable to turnover research generally Although this issue is discussed in many statistics texts and has largely been resolved in practice in other disciplines, industrial psychologists and organizational researchers seem to have been reluctant to adopt the appropriate procedures. In this article, we review these procedures and graphically illustrate how the choice of estimation technique can influence both the pattern and significance of results.

The data in this study are taken from Nancy E. Day's doctoral dissertation, which was submitted to the University of Kansas.

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Prior Work

Although the relationship between commitment and turnover is well documented, the evidence of any job-involvement–turnover relationship is considerably weaker (Cotton & Tuttle, 1986). Despite the limited empirical support for a job-involvement-turnover relationship, the potential importance of an interaction between organizational commitment and job involvement was proposed in recent theoretical work by Blau and Boal (1987). They predicted that various combinations of organizational commitment and job involvement will have distinct consequences for organizations. For example, employees who exhibit both high organizational commitment and high job involvement *(institutional stars)* should be the least likely to leave the organization. Employees with low levels of organizational commitment and job involvement *(apathetics)* should be the most likely to leave the organization voluntarily. Finally, Blau and Boal designated employees with high job involvement and low organizational commitment *lone wolves* and called employees with low job involvement and high organizational commitment *corporate citizens.* Because of their stronger organizational identification, corporate citizens were predicted to leave the organization less frequently than lone wolves.

Blau and Boal (1989) recently reported empirical support for their theory. They found the interaction of organizational commitment and job involvement to be significantly related to turnover beyond the main effects of sex, marital status, tenure, organizational commitment, and job involvement. In related studies, Blau (1986) and Mathieu and Kohler (1990) also reported support for the organizational commitment and job involvement interaction with several measures of absenteeism. Nevertheless, the extant empirical research relevant to Blau and Boal's (1987) model is deficient in several important respects. First, Blau and Boal's measures of organizational commitment are much more limited than is implied by prior empirical work. For example, organizational commitment has been found to comprise two distinct factors: attitudinal commitment and continuance commitment (Etzioni, 1961; Ferris & Aranya, 1983; Hrebiniak & Alutto, 1972; Kidron, 1978; Mathieu & Zajac, 1990; Morris & Sherman, 1981; Mowday, Porter, & Steers, 1982; Randall, 1990; Stebbins, 1970; and Stevens, Beyer, & Trite, 1978). Attitudinal commitment is affective in nature; an employee becomes emotionally attached to the organization and perceives a congruence between his or her goals and those of the organization (Mowday et al., 1982). Continuance commitment, or calculative commitment, results from the worker's entering into an exchange relationship with the organization. The degree of continuance commitment is determined by the extent to which this exchange relationship favors the employee (Day 1987).

Previous studies evaluating Blau and Boal's theory (Blau, 1986; Blau & Boal, 1989; Mathieu & Kohler, 1990) have not included measures of continuance commitment. Although Blau and Boal (1987) suggested that only attitudinal commitment is appropriate in their model, prior work (Ferris & Aranya, 1983; Mathieu & Zajac, 1990; Randall, 1990) indicates that both facets are necessary to adequately explain organizational commitment. For example, Mathieu and Zajac concluded that attitudinal and continuance commitment are highly related and that over time they may become more related as the employee remains in the firm. Moreover, although the relationship between continuance commitment and turnover is generally smaller than the relationship between attitudinal commitment and turnover (Mathieu & Zajac, 1990), the large theoretical and empirical overlap (r = .50) between these two dimensions of commitment suggests that neither should be examined in isolation.

Second, previous research has not controlled for a number of variables that have consistently been found to be important influences on turnover. For example, in a recent meta-analysis, Cotton and Tuttle (1986) found commitment, salary age, sex, organizational tenure, educational attainment, perceptions of job mobility, met expectations, work-group cohesion, opportunities for advancement, and job performance to be highly related to turnover. If these omitted variables are in turn correlated with organizational commitment and job involvement, the effects of organizational commitment and job involvement on turnover will be confounded.

OLS-Based Estimates

A third, and fundamental, problem with the previous research relating commitment to turnover concerns the widespread use of ordinary least squares regression (OLS) and related models when the dependent variable is dichotomous (Abelson, 1987; Arnold & Feldman, 1982; Blau & Boal, 1989; Chelte & Tausky, 1986; Ferris & Aranya, 1983; Horn, Katerberg, & Hulin, 1979; Michaels & Spector, 1982; Parasuraman, 1982; Pierce & Dunham, 1987; and Stumpf & Hartman, 1984). Although Blau and Boal used both analysis of variance (ANOVA) and OLS on their data, and noted their equivalence, we focus here on the OLS models because of their more frequent use in the turnover literature. However, the same criticisms apply to ANOVA models.

The use of OLS in the analysis of binary dependent variables is at best incautious; at worst, it is simply mistaken. As we demonstrate, the choice of estimation techniques is not merely an exercise in statistical arcanum but an important decision that will have substantial bearing on the interpretation of the results. In this section, we briefly review the problems associated with OLS-based procedures and the advantages of maximum likelihood (ML) procedures. In a later section, we test the conventional wisdom that the precision and convenience of OLS-based procedures justifies their continued use.

OLS and discriminant analysis (DA) are linear techniques that utilize a least squares estimation procedure, which provides unbiased parameter estimates when the dependent variable is continuous and errors are normally distributed (Maddala, 1983). Unfortunately, neither of these assumptions are satisfied when binary dependent measures, such as turnover, are employed. OLS, therefore, presents three major problems when used to estimate a binary dependent variable:

1. Predicted values can fall outside the 0-1 boundaries, yielding meaningless results (Amemiya, 1981, p. 1,486; Maddala, 1983, p. 16).

2. Heteroscedasticity and nonnormality of the errors invalidates the coefficient t tests (Doran, 1989, p. 315; Maddala, 1988, p. 269).

3. Estimates of the marginal effects of an independent variable are biased because they depend on the mean value of the dependent variable (Doran, 1989, p. 316; Maddala, 1983, p. 24).

Because OLS equations are not asymptotic to the 0,1 boundaries, predicted values are likewise not restricted. Thus, when binary dependent variables are used, OLS equations can produce anomalous results, such as predicted values less than zero or greater than unity. Heteroscedasticity of the error variance follows from the relationship between β and ε. Because the predicted value of the dependent variable must be either zero or unity, X + must sum to either zero or unity Therefore, ε must equal X or $1 - X$, and the values of ε cannot be independent of X. Although one may constrain the error terms in various ways, Greene (1990) noted that the constraints are sample dependent and that "the resulting estimator, such as it is, may have no known sampling properties" (Greene, 1990, p. 663).

Much of the utility of any type of regression procedure is the ability to estimate the change in Y for a given change in X. This is particularly true in turnover research, in which the marginal effects of the independent variables can have practical significance, given the nature of the dependent variable. With OLS estimation, these marginal effects (the coefficients) are constant over all values of X. That is, the marginal effect on turnover of a one-unit change in an independent variable is independent of the values taken by the other independent variables and the dependent variable. In other words, the effects of a change in organizational commitment would be identical for individuals who otherwise had very high or very low propensities to leave an organization. However, the function characterizing a dichotomous variable is logistic, not linear (Maddala, 1983). Therefore, the change in Y for a given change in X varies as a function of the value of X. Stated another way, because the function is nonlinear, the derivatives vary as a function of the value of the X, whereas in a linear model the derivatives are constant. For example, if the propensity to leave an organization (p_i) is a function of the logit model

$$p_i = L(I_i) = [1 + \exp(-I_i)]^{-1}, \qquad (1)$$

then

$$\frac{\partial p_i}{\partial X_{ji}} = \frac{\partial L(I_i)}{\partial X_{ji}} = \frac{dL(I_i)}{dI_i}\frac{\partial I_i}{\partial X_{ji}} \qquad (2)$$

$$= \frac{\exp(-I_i)\,\beta_j}{[1 + \exp(-I_i)]^2} \qquad (3)$$

$$= (p_i^{-1} - 1)\, p_i^2 \beta_j, \qquad (4)$$

and therefore

$$\frac{\partial p_i}{\partial X_{ji}} = p_i(1 - p_i)\beta_j. \qquad (5)$$

The term $p_i(1 - p_i)$ is small when p_i is very near zero or unity and will assume its greatest value when p_i is .5. As a result, changes in X_{ij} (the raw score for the independent variable) will have a smaller effect on the propensity to leave the firm when this propensity is near the extremes and will have the greatest effect when this propensity is .5 (Doran, 1989, p. 325). Thus, an individual who otherwise already has a high probability of leaving will have a lower marginal increase in that probability for a one-unit change in a positive-sign variable than an individual with an otherwise low probability of leaving.

Similarly, the marginal effects of a variable will rarely be the same for an increase and a decrease in that variable. As illustrated in Figure 1, only when the proportions of the dependent variable in each category (the prior probabilities) are near .5 will a linear solution reasonably approximate the data. According to Amemiya (1981, p.1, 488), OLS yields coefficients that are approximate to the correct probit and logit coefficients over the 30%-70% range of prior probabilities. Beyond this range, the OLS coefficients are highly unstable, and the estimation bias is likely to be substantial (Maddala, 1983). Maddala further (1983, p. 27) noted that "if the independent variables are not normal, the discriminant-analysis estimator is not even consistent, whereas the logit ML estimator is consistent and therefore more robust."

Thus, the use of either OLS or DA can produce significant

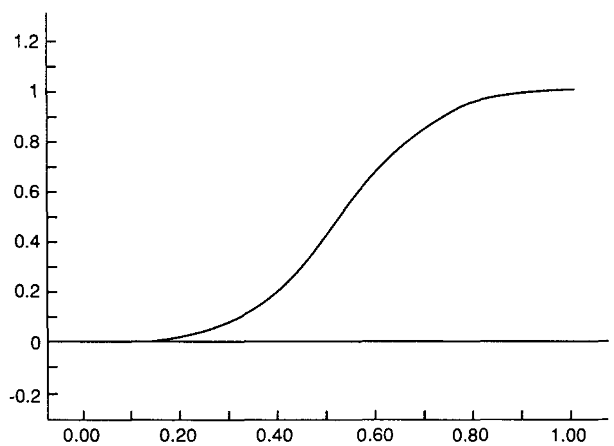

Figure 1. Sample cumulative logistic distribution.

biases when the proportions of the dependent variable in each group are unequal. Therefore, although OLS and DA yield equivalent results, they will both be biased when the dependent variable is dichotomous and one category contains most of the responses.

Unfortunately, unequal group compositions and incorrect estimation procedures are the rule rather than the exception in the turnover literature. A review of the *Academy of Management Journal, Personnel Psychology,* and the *Journal of Applied Psychology* for a 10-year period (1980-1989) located 26 studies in which turnover was used as a dependent variable and in which the researchers also purported to determine the marginal effects of a set of independent variables. In those studies (for which logistic regression would have been the appropriate estimation methodology), the average rate of turnover was 22.4%, clearly outside the bounds where OLS may be considered even marginally acceptable. However, OLS regression was used in 22 of those studies, discriminant analysis was used in 2, and an ANOVA design was used in 1. The proper logistic regression technique was used in only a single study.

These objections to the use of OLS estimates for binary dependent variables are not new and have been stated at length elsewhere (Doran, 1989; Eisenbeis, 1977; Goldberger, 1964; Greene, 1990; Hosmer & Lemeshow, 1989; Maddala, 1983; Winship & Mare, 1984). Although sometimes noted when OLS is used for dichotomous dependent measures in the organizational literature, the objections are typically dismissed by noting the equivalence between multiple regression and DA (Cohen & Cohen, 1983; Pedhazur, 1982). Because DA is widely advocated for use with categorical dependent variables, this equivalence is presented as evidence that OLS procedures also are acceptable for binary dependent measures (Cohen & Cohen, 1983; Pedhazur, 1982). Whereas the propriety of the ML procedures is typically not at issue, the argument is frequently made that the OLS procedure produces acceptable estimates (Allan, 1976; Cohen & Cohen, 1983; Kim, 1975; O'Brien, 1979; and Pedhazur, 1982). For example, Cohen and Cohen (1983, pp. 240-241) stated that "dichotomous dependent variables (employed-unemployed, married-single, pass-fail) may be coded 1-0 and used as dependent variables. With this coding, the $_i$ (and *A* and *Y*) are simply interpreted as proportions, which is very convenient." This clearly overstates the value of OLS. Although there is no dispute that OLS is very convenient, the interpretation of coefficients is less straightforward. The estimates in such a model can be interpreted as proportions, but, as discussed above, they will only be the true proportions under very limited conditions.

Alternative Estimators

The problems associated with OLS-based estimates are easily overcome. Two recent methodological developments offer alternative ways to model the turnover process. For example, Morita, Lee, and Mowday (1989) showed how the survival analysis technique can be applied to turnover research. This technique regards turnover as a process whose intensity is to be determined. Because the dependent variable to be calculated is continuous, linear estimation techniques can be used.

The cusp-catastrophe model has also been applied recently to employee separations (Sheridan, 1985; Sheridan & Abelson, 1983). This model reconceptualizes turnover as a discontinuous function of a set of independent variables. Although Sheridan (1985) inappropriately used OLS in their demonstration, this procedure represents a significant conceptual advance in turnover research. However, both of these procedures are primarily used when longitudinal data are available.

For the more common situation, in which the independent variables are only measured at a single point in time, appropriate methodologies for modeling dichotomous dependent variables are readily available. For example, probit and logit are nonlinear procedures that assume the dichotomous measure reflects an underlying, continuous latent variable (Winship & Mare, 1984). This, of course, is exactly the theoretical assumption implicit in turnover research. Moreover, these procedures have none of the limitations of the linear models discussed earlier. They can (a) accommodate the binary (0, 1) scale of the dependent measure, (b) avoid the assumptions of normality and homoscedasticity, and (c) yield accurate estimates of the marginal effects of the independent variables.

The probit and logit models differ from each other in that the former follows the standard normal distribution whereas the latter corresponds to the logistic cumulative distribution. Both, however, are very similar, differing only slightly in the tails. The estimates they yield typically differ by a constant. Although there is no theoretical reason to prefer one over the other, the logistic distribution simplifies the necessary calculations (Greene, 1990). Logistic regression (LR), perhaps the most commonly employed nonlinear regression procedure, is a logit model.

LR uses an ML parameter estimation procedure. The ML procedure derives parameters from an iterative procedure that produces the estimates most likely to have produced the sample data, in contrast to the OLS procedure, which yields estimates based on a decision rule that minimizes the square of the residuals (Maddala, 1983). Because ML estimation procedures are iterative, they can be computationally intensive. However, recent computer hardware and software advances mitigate this problem. For example, the SPSS, SAS, and BMDP statistical packages all now include nonlinear regression procedures.

Method

Subjects

The organization participating in this study is a nationwide home-products retailing firm, headquartered in the Midwestern United States (Day, 1987). Respondents were third-level supervisors, who report to an assistant supervisor, who in turn reports to the store manager. This position is homogeneous across store locations, and transfer of employees between stores is infrequent.

Data were gathered in two stages by questionnaire and from company records. In the first stage, questionnaires were mailed to the 335 managers in the 150 stores that constituted the population of locations and supervisors in this organization. Anonymity was assured for each respondent, and completed questionnaires were mailed directly to Nancy E. Day. The response rate, with 241 questionnaires returned, was 72%. One hundred nineteen of the 150 stores were represented in the sample. Ninety-two percent of the respondents were male, and nearly all (92%) were White with nonethnic backgrounds. Eighty-eight percent were age 35 or under, and 47% were between 24 and 27 years old. Sixty-two percent had college degrees.

In the second stage of data collection, store financial performance, supervisors' performance appraisals and salary history, and turnover frequency were gathered from company records. These objective data were individually matched to the questionnaire responses.

Measures

The control variables measured were age, sex, job tenure, job performance, perceptions of job mobility, the degree to which expectations were met by the job, perceptions of employee-group cohesion, perceptions of management-group cohesion, perceptions of opportunity for advancement, perceptions of pay equity, educational attainment, and whether the individual had recently refused other job offers. The management-group cohesion (α = .86) and employee-group cohesion (α = .69) scales each consisted of five items. The job mobility scale consisted of two items (α = .77), and the opportunity-for-advancement and refused-other-offers variables were measured with single-item scales. The previous years' salary and performance appraisal for each supervisor were compiled from company records. Performance appraisals were conducted quarterly by the supervisors' immediate superior; we averaged them over the year to yield a single score for each respondent. The supervisor's self-appraisal of his or her performance was assessed with the same nine scales used in the company-performance appraisals and was likewise combined into a single score (α = .80).

Organizational commitment was operationalized as consisting of two facets: attitudinal commitment and continuance commitment. Mowday, Steers, and Porter (1979) developed an instrument to measure attitudinal commitment, the Organizational Commitment Questionnaire (OCQ). This 15-item index has high internal reliability and has demonstrated both convergent and discriminant validity (Cook, Hepworth, Wall, & Warr, 1981). We used the shortened 9-item version of the OCQ, which exhibits a high correlation with the original 15-item scale (Mowday et al.) and has been widely used in the literature (Meyer, Paunonen, Gellatly, Goffin, & Jackson, 1989). Continuance commitment was measured with Alutto, Hrebiniak, and Alonso's (1973) four-item scale. This measure has good psychometric qualities (Alutto et al.) and has also been widely employed in the literature (Meyer et al., 1989). The OCQ and Alutto et al.'s continuance commitment scale had high internal reliabilities in this study (α = .92 and .89, respectively).

Job involvement was operationalized as "internalization of values about the goodness of work" and "the degree to which a person's work affects his self-esteem" (Lodahl & Kejner, 1965, p. 24 and p. 25, respectively) and was measured with Lodahl and Kejner's (1965) five-item scale (α = .59). This scale measures a sense of duty toward work, a willingness to sacrifice, and a belief in the intrinsic value of work. The interactions of interest in this study were created by the product of attitudinal commitment and job involvement and the product of continuance commitment and job involvement.

The turnover variable was coded as 1 if the respondent voluntarily terminated employment within 6 months of the questionnaire administration; otherwise it was coded 0. Of the 241 respondents in this study, 28 left the organization within 6 months of the questionnaire administration. Five of these individuals were involuntarily terminated (fired). These involuntary terminations were not included in the analyses because they are conceptually inappropriate to Blau and Boal's (1987) model. A 6-month period for assessing turnover was initially selected because the company felt it to be highly relevant. We attempted to obtain some additional data from the firm at the one-year interval, but the company was purchased by a management group approximately 18 months after the questionnaire administration, and additional data were unavailable. In any event, the annual turnover rate of approximately 20% (the 6-month rate was 23/236 or 9.8%) is consistent with previous experience for the company and its industry.

Results

We begin with an examination of several bivariate comparisons. Next we present the results of three different models analyzed with the OLS procedure. They are

Model l—replication of Blau and Boal (1989);

Model 2—Model 1 plus continuance commitment; and

Model 3—Model 2 plus an extended set of control variables. Last, to determine the degree of estimation error introduced by the OLS regression procedure, we estimated Models 1, 2, and 3 with the LR procedure and then contrasted those results with the OLS results.

Bivariate Statistics

Substantially complete data were available for all variables except supervisor's performance appraisal. Because of inconsistencies in recording this variable at the company's headquarters, only 146 performance appraisals were available. This reduced the sample for which complete data were available to 138 respondents, representing 93 stores. Of these 93 stores, the majority (56) provided a single respondent. Twenty-nine stores provided two respondents, and 8 stores provided three respondents. No store provided more than three respondents. A conservative test of the effects of multiple respondents per store would involve restricting the degrees of freedom in the significance tests to the number of stores in the data set (from 138 to 93). To do so would not alter any of the findings of this study. Thus, we feel our findings are robust to the possibility of this threat to validity

Our presentation of the sample for which complete data were available was motivated by a desire to specify the models as completely as possible and to present the most conservative results. The firm assured us that the missing performance appraisals were unrelated to location or performance level, and subsequent analyses bear this out. There were no systematic differences between responding and nonresponding stores on any of the outcome measures, nor were there any differences between responding regions in the independent variables (Day 1987).

Moreover, the analyses presented here were also conducted with the yearly performance appraisal variable removed (n = 230) to gauge the impact of the missing data on the results. The findings were consistent with what was found with the smaller sample and thus would not alter our conclusions.

The means and standard deviations for the independent variables are reported in Table 1, and the intercorrelations matrix is shown in Table 2. In short, relative to those who stayed, those who left this organization exhibited lower attitudinal commitment, lower continuance commitment, received lower salaries, were younger, had less tenure and more education, perceived less pay equity, received lower performance appraisals and rated themselves lower, had their expectations about the job met to a greater degree, and perceived less opportunity for advancement. Thus, consistent with previous research (Cotton & Tuttle, 1986), a number of the independent variables were found to be significantly related to turnover.

OLS Analysis

Using the OLS procedure, we regressed turnover on sex, tenure, attitudinal commitment, job involvement, and the Attitudinal Commitment × Job Involvement interaction as a replication of Blau and Boal's (1989) findings (Model 1). The results of these analyses are presented in Table 3. The complete equation was highly significant ($p < .01$). Consistent with Blau and Boal, we found tenure ($p < .01$), attitudinal commitment ($p < .01$), job involvement ($p < .05$), as well as the Attitudinal Commitment × Job Involvement interaction ($p < .05$) to be significant in the prediction of turnover.

Model 2 contains continuance commitment and the Continuance Commitment × Job Involvement interaction in addition to the variables in Model 1. As with Model 1, the complete equation was highly significant ($p < .01$), and tenure ($p < .01$), job involvement ($p < .05$), attitudinal commitment ($p < .05$), and the Attitudinal Commitment X Job Involvement interaction ($p < .05$) were also significantly related to turnover. However, neither continuance commitment nor its interaction with job involvement were significant.

Finally, we evaluated the effect of the extended set of control variables on the significance of both the interaction terms and the main effects for attitudinal commitment and job involvement (Model 3), where all variables were entered into the equation simultaneously. Although the order of variable entry is of significance when testing the incremental variance accounted for in a model (i.e., hierarchical regression), it does not affect the size of the coefficients in a complete model nor their interpretation. Because incremental variance was not at issue in this study, the independent variables were entered as a group.

As with Models 1 and 2, this equation was highly significant ($p < .01$). However, with the exceptions of age ($p < .01$), tenure ($p < .05$), self-rated performance ($p < .05$), and opportunities for advancement ($p < .01$), the control variables were uniformly nonsignificant by conventional standards. Nevertheless, as with Models 1 and 2, job involvement, attitudinal commitment, and their interaction were all significant at the .05 level or beyond.

In summary, the OLS estimates replicate prior evidence for Blau and Boal's theory, do not support the hypothesis that a continuance-commitment main effect or a Continuance Commitment × Job Involvement interaction exists, and suggest that reasonably parsimonious models do not confound the coefficient estimates.

Logistic Regression

Next, we reevaluated Models 1-3 with the nonlinear logistic regression procedure. These analyses are presented in Table 4. A number of alternative indices of nonlinear model fit are available, including classification tables, histograms of predicted and actual probabilities, various pseudo- R^2 measures, Amemiya's (1985) prediction criterion (PC), Akaike's (1973) information criterion (AIC) and the chi-square tests presented here. Classification tables, histograms, and pseudo- R^2 mea-

Table 1
Means and Standard Deviations for All Variables

Variable	Coding range	Stayers (N= 115)	Leavers (N= 23)	All respondents (N= 138)
Attitudinal commitment	1-7			
M		5.51	4.79	5.39
SD		1.01	1.48	1.13
Continuance commitment	1-3			
M		2.27	1.88	2.20
SD		0.65	0.55	0.65
JI	1-7			
M		5.47	5.25	5.43
SD		0.81	1.04	0.85
Yearly salary ($)[a]				
M		21,867.83	21,167.39	21,751.09
SD		1,657.35	1,051.90	1,591.22
Age[b]	1-12			
M		3.99	3.22	3.86
SD		1.24	0.85	1.22
Tenure	1-9			
M		3.57	2.87	3.45
SD		1.29	1.01	1.27
Education[c]	1-12			
M		6.87	7.70	7.01
SD		1.83	1.66	1.82
Perception of pay equity	1-7			
M		3.36	2.61	3.23
SD		1.89	1.44	1.84
Yearly performance appraisal	1-5			
M		3.39	3.04	3.34
SD		0.50	0.41	0.50
Self-rated performance	1-5			
M		3.99	3.78	3.96
SD		0.41	0.53	0.44
Perceptions of job mobility	1-7			
M		2.27	1.87	2.20
SD		1.22	0.80	1.17
Degree that job met expectations	1-5			
M		2.80	3.35	2.89
SD		1.15	1.15	1.16
Employee-group cohesion	1-5			
M		2.96	2.89	2.95
SD		0.40	0.31	0.39
Management-group cohesion	1-5			
M		2.90	2.86	2.89
SD		0.59	0.48	0.57
Perceived opportunity for advancement	1-7			
M		5.65	4.39	5.44
SD		1.30	1.85	1.48
Receipt of other job offers[d]				
M		1.39	1.22	1.36
SD		0.49	0.42	0.49

Note. Larger values indicate more of each attribute. JI = job involvement.
[a] Salary ranged from $16,300 to $27,950.
[b] l = 16 to 18 years; 2 = 19 to 23 years; 3 = 24 to 27 years; 4 = 28 to 30 years; 5 = 31 to 35 years; 6 = 36 to 40 years; 7 = 41 to 45 years; 8 = 46 to 50 years; 9 = 51 to 55 years; 10 = 56 to 60 years; ll = 61 to 65 years; 12 = 66 or older.
[c] 1 = 9th grade; 2 = 10th grade; 3 = 1lth grade; 4 = 12th grade; 5 = 1 year postsecondary; 6 = 2 years postsecondary; 7 = 3 years postsecondary; 8 = 4 years postsecondary; 9 = 5 years postsecondary; 10 = 6 years postsecondary; 11 = 7 years postsecondary; 12 = 8 years postsecondary; 13 = 9 or more years postsecondary.
[d] 1 = true; 2 = false.

Table 2
Intercorrelations Matrix for All Variables

Variable	1	2	3	4	5	6	7	8
1. Turnover	—							
2. Attitudinal commitment (AC)	–.24**	—						
3. Continuance commitment (CC)	–.22**	.51**	—					
4. Job involvement (JI)	–.09	.42**	.19*	—				
5. AC × JI	–.19*	.88**	.46**	.78**	—			
6. CC × JI	–.26**	.78**	.93**	.32**	.70**	—		
7. Yearly salary	–.16*	.03	.10	.06	.04	.10	—	
8. Age	–.24**	–.01	.05	.03	–.01	.05	.28**	—
9. Tenure	–.21**	–.05	–.01	–.02	–.06	–.04	.68**	.21**
10. Education	.17*	–.18*	–.32**	–.10	–.17*	–.31**	–.04	–.09
11. Perception of pay equity	–.15*	.32**	.29**	.15*	.31**	.35**	.26**	–.03
12. Yearly performance appraisal	–.27**	.18*	.28**	.02	.13	.28**	–.14	–.11
13. self-rated performance	–.18*	–.05	.04	.01	–.02	.00	.06	–.04
14. Perceptions of job mobility	–.13	–.08	–.08	–.04	–.10	–.09	–.07	–.04
15. Degree that job met expectations	.18*	–.52**	–.37**	–.23**	–.46**	–.47**	.09	.06
16. Employee-group cohesion	–.07	.28**	.17*	.07	.21**	.24**	.03	–.06
17. Management-group cohesion	–.03	.35**	.40**	.11	.30**	.44**	–.01	.03
18. Perceived opportunity for advancement	–.32**	.42**	.40**	.08	.35**	.45**	–.09	–.01
19. Receipt of other job offers	–.10	–.07	–.02	–.11	–.11	–.02	–.06	–.04
20. Sex	–.01	.08	–.04	.09	.10	.01	–.03	–.11

Note. $N = 138$.
$*p < .05$. $**p < .01$.

sures have a number of well-known undesirable properties (Aldrich & Nelson, 1984). The AIC and PC measures have been proposed as offering more parsimonious methods to identify the model with the optimum number of independent variables, although a number of authors have been critical of these procedures (Dharan, 1983; Greene, 1990; Sawa, 1978). However, the chi-square test, although conservative, has well-known properties and is generally accepted. In any event, the use of either the AIC or PC would not alter the conclusions of this study.

Model lL contains the replication of Blau and Boal's (1989) model, which is a parallel equation to Model 1. The chi-square statistic for the –2 log likelihood (presented in Table 4) represents an index of the probability of observing the results in the sample given the estimated parameters. An adequate model has a large probability of obtaining the observed results (Aldrich & Nelson, 1984). The null hypothesis in this case is that the observed likelihood is not significantly different from 1 (a model with perfect fit). Thus, the chi-square test for Model IL does not reject this hypothesis, indicating an adequate model.

The model chi-square represents a comparison between the model with all coefficients restricted to zero and the estimated model. This test is comparable to the overall *F* test in OLS regression (Norusis, 1989). For Model lL this test ($p < .02$) rejects the hypothesis that all of the coefficients in the model are equal to zero. Therefore, the complete model fits significantly better than does a model containing only the constant.

Finally, the LR procedure uses the Wald statistic to test the significance of individual variables in the model. This test is conceptually equivalent to the *t* tests reported in the OLS equations, although it differs in computation (Greene, 1990). These tests indicated that only tenure ($p < .05$) was significant at conventional levels.

Next, Model 2L presents the results of the equation in which continuance commitment and the Continuance Commitment × Job Involvement interaction were added to the predictors used by Blau and Boal (1989). This is equivalent to Model 2 in the OLS analysis. As did Model lL, this model showed a high probability of observing the predicted results, which defines the model as adequate. The model chi-square was significant ($p < .01$), indicating that the model represents a significant improvement over a model containing only the constant. And, consistent with Model lL, tenure ($p < .01$) was the only independent variable to reach significance.

Finally Model 3L shows the results of the LR equation with the complete set of predictor variables, which is equivalent to the OLS Model 3. As with Models lL and 2L, the –2 log likelihood chi-square suggests this is an adequate model. However, the model chi-square is not significant, indicating that the complete model does not represent an improvement over a model containing only the constant. In part, this reflects the loss of degrees of freedom with the addition of predictors. However, age ($p < .01$), opportunity for advancement ($p < .01$), self-rated performance ($p < .05$), tenure ($p < .05$), and the constant ($p < .05$) were significantly related to turnover. Nevertheless, and

9	10	11	12	13	14	15	16	17	18	19	20
—											
−.01	—										
.07	−.16**	—									
−.04	−.23**	.09	—								
.02	.17*	−.10	.21**	—							
−.03	−.07	−.05	−.01	.00	—						
.26	.17*	−.34**	−.13	−.03	.01	—					
.10	.04	.08	−.04	.06	.05	−.04	—				
.03	−.25**	.28**	−.05	−.07	−.02	−.26**	.19*	—			
−.15*	−.29**	.21**	.20**	.08	.05	−.57**	−.02	−.28**	—		
−.09	.02	.12	.07	−.08	.20	−.06	.01	−.04	.02	—	
−.08	.00	.04	.05	.03	−.02	−.12	.20	−.05	.07	−.10	—

consistent with Models IL and 2L, neither job involvement, attitudinal commitment, continuance commitment, or any interaction term was significant.

Summary

The OLS equations show considerable support for the existence of an Attitudinal Commitment × Job Involvement interaction, as well as significant coefficients for attitudinal commitment and job involvement. The addition of a number of covariates did not alter this conclusion. However, the LR procedure found none of the main effect or interaction terms to be significant. In short, the OLS procedure overstated the influence of job involvement, commitment, and their respective interactions on turnover, compared with the logistic regression analyses. Therefore, following these conventional linear estimation procedures would lead us to the incorrect conclusion that our hypotheses had been supported.

Discussion

The confirmatory results obtained with the use of linear procedures appear to be dependent on the choice of estimation techniques. Blau and Boal's (1989) results were precisely replicated with the OLS procedure but not with the LR procedure. The implications of these results generalize to the wider turnover literature because the same pattern of results was obtained after relevant covariates from prior turnover research were included in the analyses. The differences in the findings are striking. The OLS results suggest significant Organizational Commitment × Job Involvement interactions with turnover, whereas the LR results suggested none. The disparity in these results casts serious doubt on the empirical support for Blau and Boal's (1987) hypotheses and on much of the turnover literature in general. (We contacted Dr. Blau and requested his data set for reanalysis and presentation in this study, but he did not respond.)

The practical implications of the two estimation procedures is illustrated by a closer examination of the marginal effects of the independent variables in the two procedures. As an example of the magnitude of estimation error introduced by the linear model, Table 5 shows the predicted turnover probabilities generated by the OLS and LR procedures. In Models 1 and lL, the sex and tenure variables were held constant at their mean, and attitudinal commitment, job involvement and the Attitudinal Commitment × Job Involvement interaction were varied in standard-deviation increments. At the mean level, both procedures produced similar estimates of the turnover level in the sample (23/138 = 16.7%). However, an increase of one standard deviation in the variables was predicted by OLS to produce a 0% probability of turnover; an increase of 2 standard deviations was predicted to produce a 16% negative probability of turnover. Of course, both of these findings are nonsensical. Similarly, OLS predicted a constant 16.43% increase in

Table 3
Ordinary Least-Squares Regression of Turnover on Models 1, 2, and 3

Variable	Model 1	Model 2	Model 3
Constant			
B	2.05490**	2.18478**	3.41721**
SE	0.74355	0.86782	1.15317
Job involvement (JI)			
B	–0.24432*	–0.31285*	–0.31718*
SE	0.14751	0.15104	0.15272
Attitudinal commitment (AC)			
B	–0.32961**	–0.31360*	–0.29806*
SE	0.14422	0.15964	0.15678
AC × JI			
B	0.04869*	0.06236*	0.05829*
SE	0.02793	0.02878	0.02902
Tenure			
B	–0.05888*	–0.05838**	–0.07046*
SE	0.02433	0.02424	0.03288
Sex			
B	–0.02507	–0.04853	–0.04503
SE	0.13943	0.13910	0.13316
Continuance commitment (CC)			
B		0.06044	0.00749
SE		0.29318	0.28167
CC × JI			
B		–0.02934	–0.01037
SE		0.05159	0.05025
Perception of job mobility			
B			–0.02164
SE			0.02538
Yearly salary			
B			0.00002
SE			0.00003
Management-group cohesion			
B			0.09100
SE			0.05741
Self-rated performance			
B			–0.13927*
SE			0.06912
Education			
B			0.00881
SE			0.01733
Receipt of other job offers			
B			–0.09641
SE			0.06091
Perceived opportunity of advancement			
B			–0.08305**
SE			0.02573
Yearly performance appraisal			
B			–0.09719
SE			0.06480
Employee-group cohesion			
B			–0.01633
SE			0.08045
Age			
B			–0.06014**
SE			0.02490
Perceptions of pay equity			
B			–0.01794
SE			0.01816
Degree that job met expectations			
B			–0.01675
SE			0.03463
R	0.35290	0.38607	0.59859
R^2	0.12454	0.14905	0.35831
F	3.75543**	3.25291**	3.46791**

Note. $N = 138$.
$*p < .05$. $**p < .01$.

Table 4
Logistic Regression of Turnover on Models IL, 2L, and 3L

Variable	Model 1L	Model 2L	Model 3L
Constant			
B	–8.9898	10.0803	41.1228*
SE	5.3385	6.4096	16.9662
Job involvement (JI)			
B	–1.0455	–1.8057	–2.9708
SE	1.0423	1.1348	1.8184
Attitudinal commitment (AC)			
B	–1.8412	–1.7366	–2.8279
SE	1.1081	1.2174	1.9462
AC × JI			
B	0.2366	0.4059	0.6381
SE	0.2106	0.2323	0.3648
Tenure			
B	–0.6549*	–0.7353**	–1.2935*
SE	0.2592	0.2765	0.5589
Sex			
B	–0.0845	–0.2902	–0.3297
SE	1.1491	1.1661	1.6313
Continuance commitment (CC)			
B		1.3178	0.6743
SE		2.4138	3.1153
CC × JI			
B		–0.4170	–0.2462
SE		0.4366	0.5749
Perceptions of job mobility			
B			–0.1546
SE			0.3579
Yearly salary			
B			–0.0004
SE			0.0004
Management group cohesion			
B			0.9285
SE			0.7005
Self-rated performance			
B			–2.3219*
SE			0.8902
Education			
B			–0.0415
SE			0.2629
Receipt of other job offers			
B			–0.8944
SE			0.8003
Perceived opportunity for advancement			
B			–1.1416**
SE			0.4229
Yearly performance appraisal			
B			– 1.8445
SE			1.0558
Employee-group cohesion			
B			0.3791
SE			1.0253
Age			
B			–1.1919**
SE			0.4541
Perceptions of pay equity			
B			–0.3088
SE			0.2803
Degree that job met expectations			
B			–0.0124
SE			0.5293
–2 log likelihood chi-square	107.077	101.897	59.826
Model chi-square	10.762*	15.941**	4.546

Note. N = 138.
* $p < .05$. ** $p < .01$.

Table 5
Models 1 and 1L: Predicted Turnover Probabilities for OLS and LR, Given Unit Standard Deviation Changes in Attitudinal Commitment (AC), Job Involvement (JI), and AC × JI and All Other Independent Variables Set at Their Means

Change in AC, JI, and AC × JI	OLS (%)	LR (%)
+ 2 standard deviations	–16.03	2.16
+ 1 standard deviations	0.41	5.59
M	16.84	14.43
– 1 standard deviations	33.27	37.27
– 2 standard deviations	49.70	96.23

Note. OLS = ordinary least-squares regression; LR = logistic regression.

the probability of turnover for each standard-deviation decrease in the independent variables.

The LR procedure predicted diminishing returns for increasing levels of attitudinal commitment, as would be expected, as well as much larger estimates of turnover probability when organizational commitment and job involvement are below their mean. As noted previously, with LR the change in the predicted probabilities was asymmetrical; that is, a decrease of one standard deviation in attitudinal commitment caused a larger change in the predicted probability of turnover than did an increase of one standard deviation. Moreover, the LR procedure produced predicted probabilities of turnover that were all positive (the reader is reminded that the variables used in this demonstration were not statistically significant and that these interpretations are therefore suspect).

Thus, the results from this study based on a more comprehensive model, a broader definition of commitment, and a more appropriate estimation procedure, indicate little support for Blau and Boal's (1987) hypotheses. Although such hypotheses may be theoretically justified, prior empirical support may be largely dependent on the estimation procedure employed.

The more general issue raised in this article, as it applies to the wider area of turnover, is the use of OLS procedures in the analysis of dichotomous dependent variables. When the prior probabilities of turnover are between .3 and .7, the function is essentially linear and the damage is minimized when OLS and DA approaches are used. However, beyond these limits, the logistic function becomes asymptotic to the 0,1 boundaries, and the linear model produces substantial error.

With regard to the prediction of turnover, for which the prior probabilities are frequently outside the .3 to .7 range and the independent variables are rarely normally distributed, these findings clearly illustrate the pitfalls of approximation and convenient methods of data analysis. Although, in their meta-analysis, Cotton and Tuttle (1986) concluded with "strong confidence" that commitment is related to turnover, the use of linear techniques in prior work raises serious reservations about the validity of those findings. Organizational researchers, in any work requiring dichotomous dependent variables, must recognize that continued use of inappropriate estimation procedures dramatically increases the risk of erroneous results.

Given the ease of computation of nonlinear models, their ready availability in popular statistical packages, and output similar to that produced by OLS regression, there is no convincing argument for the use of linear techniques for binary dependent variables. To paraphrase Box (1953, p. 333): To use OLS regression with binary dependent variables is rather like putting to sea in a rowing boat when one already has tickets aboard an ocean liner.

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