



The Employee Separation Process: Criterion-Related Issues Associated with Tenure and Turnover

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The point is made that employee separation researchers have failed to distinguish among separation criteria, leading to inaccurate parameter estimation and evaluation. It is recommended that separation be viewed as either a dichotomous (e.g., avoidable vs. unavoidable or functional vs. dysfunctional) or a dichotomized variable (e.g., membership in a long- or short-tenure group). Likewise, it is argued that type of separation criterion specified determines the appropriateness of a specific estimator. In the case of a truly dichotomous criterion, the point-biserial correlation is of interest, whereas in the case of a dichotomized criterion, the biserial correlation is the proper estimator. Related statistical issues are addressed.

Employee separation has been a focus of behavioral research for nearly eight decades (Crabb, 1912). Until the mid-1970s, a vast majority of the research on employee separation had focused on estimating bivariate relationships between turnover (i.e., attrition) and predictors such as job satisfaction or organizational commitment. More recently, however, interest has focused on developing increasingly complex multivariate models of the employee separation process (e.g., Koslowsky, 1987; Mobley, Griffeth, Hand, & Meglino, 1979; Price, 1977; Steers & Mowday, 1981).

The increasing complexity of these models has been justified based on the rather consistent observation that previous explanations have failed to capture the lion's share of variance in separation behavior (Mobley et al., 1979). The results of both bivariate and multivariate models suggest that there is much to be understood about the dynamics of the employee separation process. A review of this research, however, clearly establishes that most separation models have tried to

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identify the relevant causes or antecedents of employee separation decisions. As a consequence of this predictor-driven focus, conceptual analysis of separation as a criterion has lagged, and various alternative explanations for predictor-separation relationships have been obscured. This is unfortunate, because how separation is conceptualized has important, but seldom acknowledged statistical implications for evaluating research on the separation process.

It is the purpose of this article to acknowledge the statistical subtleties involved when defining a separation criterion as either a true dichotomy or a dichotomized representation of an underlying continuous variable. Focus is limited to traditional ways of estimating separation correlations (i.e., point-biserial and biserial correlations). Other procedures have been recently advocated for this area of research (e.g., survival analysis; Peters & Sheridan, in press), but such procedures are beyond the intended scope of this article.

Separation as a Criterion

With little exception (*viz.*, Bluedorn, 1982), reviews of the employee separation process have not addressed criterion-related issues. The limited coverage that has been given to separation as a criterion has focused on (a) differentiating between types (e.g., avoidable vs. unavoidable or functional vs. dysfunctional) of separation (e.g., Abelson & Baysinger, 1984), (b) analyzing the impact of data recording errors (e.g., Ilgen, 1977; Latham & Pursell, 1977), and (c) addressing the question of data aggregation (e.g., Price, 1977). Of particular concern to the purpose of the present article has been the tendency for researchers to use the terms *tenure* and *turnover* as though they were interchangeable constructs. For example, in his comprehensive review of the relevant literature, Schuh (1967) cites various studies in which employee tenure was operationalized as either the amount of time an employee remained on a job, or as a dichotomy representing long- or short-tenure groups. Table headings throughout the review, however, refer to research on "predicting a criterion of labor turnover." This confusion has been apparent even more recently in an updated review by Muchinsky and Tuttle (1979). They refer to numerous studies in which turnover has been operationalized by separating employees into criterion groups based on their length of service (i.e., *tenure*). This confusion is further confounded in those instances where they reference those studies previously reviewed by Schuh (1967). Not only do Muchinsky and Tuttle (1979) use the terms *tenure* and *turnover* interchangeably, but they reverse the signs of the predictor-criterion correlations given from the studies they cite. That is, for studies originally finding positive predictor-criterion correlations for *tenure*, Muchinsky and Tuttle (1979) report negative predictor-criterion correlations for *turnover*.

To clarify conceptual (and as we will argue later, statistical) problems in the employee separation literature, we propose that the term *tenure* be used to denote length of stay, as measured by actual time employed in a job, or length of service subsequent to a measurement process (e.g., questionnaire administration). Thus, when measured as actual length of service, or its dichotomization (e.g., membership in long- or short-tenure groups), the term *tenure* would be preferred. The term *turnover* on the other hand, should be reserved for truly discrete (i.e., cate-

gorical) variables such as termination status (e.g., voluntary vs. involuntary) or qualitatively different types of separation (e.g., functional vs. dysfunctional).

As Cook and Campbell (1979) note, construct definition and operationalization are extremely important research issues. In the present instance, how separation is conceived (as either a true dichotomy or a continuous variable) bears on the type of predictor-criterion correlation that should be estimated. Moreover, it has substantive implications for interpreting statistical results. If tenure or length of service is the research focus, and this is operationalized as a dichotomized variable, then the biserial correlation (r_b) is of interest. Likewise, if predicting the way in which a person terminates employment, or if correlates of a turnover utility criterion (i.e., functional versus dysfunctional) are of interest, the categorical nature of these criteria necessitates the use of the point-biserial correlation (r_{pb}). As we will show below, confusion in this regard has led to problems concerning the evaluation of studies exploring the employee separation process.

Point-Biserial Correlation

A point-biserial correlation (r_{pb}) is defined as a measure of the relationship between a truly dichotomous construct (e.g., gender or race) and some continuous variable. It is given by

$$r_{pb} = \frac{\bar{Y}_1 - \bar{Y}_t}{S_y} (p/q)^{\frac{1}{2}}, \quad (1)$$

where \bar{Y}_1 is the mean of the continuous variable (Y) for those subjects in the upper category of the focal dichotomous variable; \bar{Y}_t is the mean of all subjects on Y ; S_y is the pooled standard deviation of Y ; and p and $q (= 1 - p)$ are the proportions of the subject sample in the upper and lower dichotomous categories. Because Equation 1 is mathematically equivalent to the Pearson product-moment formula, it is important to note that standard statistical packages (e.g., BMDP, SPSS_x) automatically generate a point-biserial correlation when a construct that has been dummy coded (0, 1) is correlated with a continuous variable.

According to McEvoy and Cascio (1987), most research concerned with turnover as a form of employee separation has estimated the point-biserial correlation (p. 750). A basic assumption associated with use of the point-biserial correlation is that the focal dichotomous categories are fundamentally distinct. This assumption, however, is not met in studies concerned with turnover because category membership, at least partially, depends on the length of the chosen measurement window. Other things being equal, turnover in any given study will increase monotonically over time. "Indeed," as Peters and Sheridan (in press) observe, "it is only a matter of time, albeit an extended amount of time in some organizational samples, before all persons in a cross-sectional sample can be expected to terminate!"

Thus, r_{pb} is not only a function of the underlying relationship being estimated, but also a proportion of observations in each category of the dichotomous variable. A point-biserial correlation reaches its maximum value when the proportions in the two categories are equal. That is, in the context of a turnover study, when

50% of the subjects are "stayers" and 50% are "leavers." Or, with respect to Equation 1, when $p = q = 1/2$. Deviations in either direction from this 50/50 split will result in an attenuated correlation (Ferguson, 1976).

The effects of various p - q "splits" have been recently demonstrated using actual turnover data by McEvoy and Cascio (1987). They grouped point-biserial correlations between employee performance and turnover into two categories. The "even split" category included nine studies in which p ranged from 0.40 to 0.60. The "disparate" category included 12 studies in which p was $< 40\%$ or $> 60\%$. As predicted from what is known about the effect of disparate splits, the adjusted meta-correlation in the even split category was larger (by a factor of nearly two; $r = -0.40$, corrected $SD = .18$) than the adjusted meta-correlation in the disparate group ($r = -0.21$, corrected $SD = .12$).

McEvoy and Cascio (1987) note that this difference does not necessarily mean that point-biserial correlations from disparate splits are flawed. It does mean, however, that they cannot be compared to point-biserial correlations obtained from nearly-even splits. Thus a premise of the McEvoy and Cascio (1987) article is that statistical adjustments may be necessary before comparing point-biserial correlations. Given that comparability is a concern, then clearly what is needed is a way to estimate what the observed r_{pb} would likely have been with an even split. Kemery, Dunlap, and Griffith (in press) have developed a procedure for accomplishing such estimates, and this procedure is recommended prior to comparing point-biserial correlations from different studies. As we will argue below, in contrast with McEvoy and Cascio (1987), if tenure is measured as a dichotomized variable, then the point-biserial correlation is inappropriate for indexing relationships.

Another statistical aspect of point-biserial correlations should also be considered. When Y is normally distributed, and when $p = q$, the r_{pb} effective range is not -1.0 to 1.0 . Rather, r_{pb} is limited to the range ± 0.798 (Cohen, 1983). With unequal divisions, the constraints are more severe. For example, when $p = 0.3$, the r_{pb} effective range is ± 0.758 . The maximum value of r_{pb} for any $p - q$ split can be found by

$$r_{pb\max} = \frac{h}{(pq)^{\frac{1}{2}}} \quad (2)$$

where h is the ordinate (height) of the normal curve at p . As a consequence of this correlational range restriction, traditional ways of estimating strengths of relationship (i.e., r , R , and R^2) may be misleading when applied to turnover studies. That is, turnover predictors may have accounted for more "effective" variance than researchers have been led to believe.

One solution to this problem is to compare the variance accounted for with the maximum variance possible given a study's parameters. This approach is similar to the *efficiency index* (ϕ/ϕ_{\max}) developed by Cureton (1959). Equation 2 can be used for this purpose. To illustrate, suppose research found a multiple R of 0.60 between a set of predictors and turnover (defined as a truly dichotomous variable). Let us also assume that for this study, the number of leavers equaled

the number of stayers (i.e., $p = q = 0.50$). From these observations, the researcher would likely conclude that 36% of the variance in turnover was explained. Or, alternatively, that 64% of the variance was unexplained. From these findings, one might conclude that unidentified predictors were present. The largest variance that could be accounted for (under the usual normality assumption) is approximately 64%. The ratio of actual variance accounted for (36%) to the variance to be accounted for (64%) is 0.56, a much more optimistic estimate of the study's predictive effectiveness.

It should be stated that the preceding analysis assumed that all constructs (both predictors and criterion) were measured with perfect reliability, an assumption unmet in most research. The effect of unreliability in the bivariate case is to attenuate the expected value of rho by a factor of the product of the square roots of the two constituent reliabilities (e.g., Nunnally, 1978, p. 220). With this logic extended to the multivariate prediction of tenure, if it is assumed that the predictor composite had a reliability of 0.7 (and tenure is measured perfectly), then R_{pbmax} would be decreased by a factor of $0.7^{1/2}$. When the adjusted variance to be accounted for (44.8%) is compared with the actual variance accounted for (36%), the study now accounts for 80% of the variance in turnover, an even more optimistic assessment of the study's predictive effectiveness.

Biserial Correlation

As noted, use of point-biserial (r_{pb}) correlations in separation research is predicated on the assumption that turnover is a true dichotomous variable. In reality, of course, as McEvoy and Cascio (1987) observe, "turnover is a dichotomization of the continuous variable called tenure" (p. 750). Inasmuch as turnover is defined as an underlying continuous variable (i.e., tenure) that has been dichotomized into two coarse categories (i.e., stayers and leavers), the biserial r_b is the correct correlation, not the point-biserial r_{pb} .

The biserial correlations (r_b) estimates the product-moment correlation that would have been obtained had an artificially dichotomized variable (e.g., tenure) been a normally distributed continuous variable. It is given by

$$r_b = \frac{(\bar{Y}_p - \bar{Y}_q)pq}{h(Sy)} \quad (3)$$

where \bar{Y}_p and \bar{Y}_q are the Y means for the two categories of a dichotomy. P is the proportion of the sample in the upper category; h is the ordinate of the normal curve at the point at which its area is divided into p and q ($= 1 - p$) portions; (Sy is the pooled standard deviation of Y). If Equations 1 and 3 are compared, the relationship between r_b and r_{pb} is given as

$$r_b = r_{pb} (pq)^{1/2} / h. \quad (4)$$

As compared to point-biserial r_{pb} , biserial r_b has three important properties.

First, its effective range is unconstrained (and may even exceed 1.0 when Y is not normally distributed; Cohen & Cohen, 1983, p. 67). Therefore, interpretation of r_b is relatively comparable to a product-moment correlation calculated from continuous variables. Second, r_b is unaffected by various $p = q$ splits, thus eliminating bias attributable to unequal breaks in an underlying continuous variable (e.g., tenure). Third, r_b is always larger than its corresponding point-biserial r_{pb} by a factor of $(p/q)^{1/2}/h$. To illustrate, r_b will be some 25% larger than the corresponding r_{pb} when the $p - q$ split is .50/.50. The ratio of r_b/r_{pb} will increase as this break is more extreme. With a break of .80/.20 (not uncommon in turnover research), r_b will be about 40% larger than r_{pb} .

As an operational example of this third property, consider the results reported by Arnold and Feldman (1982). In a test of a turnover model they reported a multiple $R = .44$. Traditionally interpreted, this would mean that 19.4% of turnover variance was accounted for by the model. Or, alternatively, 80.6% of turnover variance was unexplained. If we apply the above logic, R_b (i.e., the multiple correlation with a continuous criterion) can be estimated using Equation 4. The proportion of leavers in the Arnold and Feldman study was 0.225 ($q = 0.775$), and the normal curve ordinate h at $p = 0.225$ was 0.2999. If we substitute these figures, and 0.44 for r_{pb} into Equation 4, the estimated $R_b = 0.618$. This is a substantial increase (nearly 40%) in the estimated correlation, as well as a more accurate (and optimistic) estimate of the focal model's utility.

It should be noted that r_b is not without its critics. Nunnally (1978, pp. 136-137), for example, asserts that r_b paints a faulty picture of a focal underlying product-moment correlation. He also asserts that r_b should not be used in multivariate analyses such as ordinary least-squares regression and factor analysis. Similarly, Cohen and Cohen (1983) assert that because r_b is an estimated rather than observed correlation, caution is necessary when using biserial correlations in multivariate investigations. These assertions, however, are offered without empirical evidence or a mathematical demonstration of these purported negative properties.

Not all psychometricians agree with Nunnally (1978) and Cohen and Cohen (1983) that corrections for dichotomization should not be used. For example, Rummel (1970), in a discussion of how to treat bivariate correlations obtained when both variables have been dichotomized (e.g., inter-item correlations from standardized tests), notes that failing to correct for dichotomization prior to factor analysis results in spurious method factors. To minimize this problem, several methodologists have recommended correcting "raw" coefficients (i.e., those based on double-dichotomization) by using either the phi/phi-max statistic or the tetrachoric r to estimate product-moment correlations (Carroll, 1961; Cattell, 1952; Wherry & Gaylord, 1944). Consistent with this, we recommend using the biserial correlation for estimating relationships involving tenure (measured as a dichotomy) and continuous variables. It would also follow that when two variables have been dichotomized researchers may consider using either the phi/phi-max statistic or the tetrachoric r for estimating relationships between the variables. Issues relating to this, however, are beyond the scope of this paper.

Conclusion

The purpose of this article has been to explicate various important, but seldom acknowledged, statistical implications associated with the concept of employee separation. We have addressed various issues associated with how separation is operationalized and how this bears on interpreting the predictor-criterion relationship that should be estimated.

The implications of criterion definition for research on employee separation are straightforward. When the continuous variable tenure is the criterion of interest, predictor-criterion relationships should be estimated by the product-moment correlation. If tenure has been dichotomized, then the biserial correlation should be estimated. If, on the other hand, the criterion is categorical, then, depending on the nature of the second variable, either the point-biserial or phi coefficient is the appropriate estimator (see Van Fleet & Chamberlain, 1979, for a discussion of how to estimate relationships when both variables are truly dichotomous). Researchers are encouraged to recognize that how separation is conceptualized has important statistical implications for evaluating research on the separation process.

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