Temporal aspects of job mobility: A comparison of traditional and survival analysis

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ABSTRACT

In response to criticism over inherent flaws associated with traditional cross-sectional window research designs and analytical methods in turnover research, new methodological approaches such as survival analysis have been proposed. The objective of this study is twofold. First, this study reviews some major methodological issues. Second, using a national sample, this study compares the results from traditional analytical methods such as OLS and logistic regression analyses, and survival analysis. Though there were similarities as well as differences in results across different analytical methods, this study found some evidence supportive of the utility of survival analysis in investigating temporal aspects of turnover over time. Before abandoning traditional methods, yet, more research comparing results from traditional and new methods needs to be done.

Keywords: turnover, cross-sectional design, OLS and logistic regression, survival analysis.

INTRODUCTION

After decades of turnover research, there has been an increasing criticism about the inability of the existing literature to produce consistent empirical findings and practical implications for effective turnover management. In response, some scholars have called for fundamental changes in conceptual and methodological approaches to turnover research (Allen, Bryant, & Vandaman, 2010; Hulin, Roznowski, & Hachiya, 1985; Lee, Holtom, McDaniel, & Hill, 1999; Lee & Mitchell, 1994; McEvoy & Cascio, 1985; O'Reilly, 1991; Peters & Sheridan, 1988; Somers & Birnbaum, 1999). This study addresses some major methodological issues associated with traditional turnover research and explores new methodological approaches to turnover research. In light of research design and methodological flaws inherent in the traditional cross-sectional window design, Peters and Sheridan (1988) argued that traditional research designs should be largely abandoned in future turnover research. They further suggested that turnover research needs to be refocused on studying temporally dynamic relationships between turnover determinants and turnover. That is, narrowly focusing on static relationships between covariates during an arbitrary calendar period cannot fully explain the dynamic flow of individuals through an organization over time. The objective of study is twofold. First, this study reviews some methodological issues that highlight the limitations of the traditional cross-sectional window design in studying the temporal aspects of turnover. Second, using different analytical methods (i.e., ordinary least squares regression, logistic regression, and survival analysis), this study analyzes a national sample from the National Longitudinal Survey of Youth (NLSY), and compares the results across these different analytical methods.

METHODODOGICAL ISSUES

This section reviews some major issues concerning traditional turnover research designs (Morita, Lee, & Mowday, 1989; Peters & Sheridan, 1988; Singer & Willett, 1991; Somers & Birnbaum, 1999). In particular, main focus is on three methodological issues identified by Peters and Sheridan (1988): (1) the length of the study window, (2) right censoring, and (3) left censoring.

Length of the study window

In previous turnover research, in particular, studies with a cross-sectional research design, arbitrary choice of the length and timing of the study window has been common practice. A potentially significant implication of this research practice is that research results may be influenced by the length and timing of the study window. For example, the relative proportion of stayers and leavers during a study period may vary contingent on when and how long employees are observed. The dependence of empirical findings on the timing and length of the study window may place some serious limits on the validity and generalizability of the results found in previous studies.

First, it is a well-known statistical result that the magnitudes of point-biserial correlations between predictors and turnover are sensitive to the base rate of turnover, that is, the relative proportion of stayers and leavers in a particular sample (Steel & Griffeth, 1989). Either a very wide or narrow study window may result in a substantial deviation from the optimal base rate (e.g., 50%). That is, a very small number of leavers (stayers) relative to that of stayers (leavers) could attenuate the correlations among the variables of interest. This concern has been confirmed

by several meta-analyses that found the moderating effects of the base rate and the length of the study window (Carsten & Spector, 1987; Hom, Caranikas-Walker, Prussia, & Griffeth, 1992; McEvoy & Cascio, 1987). Given substantial variations in turnover rate and the length of the study window in previous studies, this problem also makes it very difficult to cross-validate empirical findings across different studies. Another related concern is what Peters and Sheridan (1988) referred to as the interpretation problems. These problems arise mainly due to a temporal misalignment between the chosen study window and dynamic turnover processes unfolding over time. For example, a very short study window may not allow the entire turnover processes of different individuals to unfold over an extended period of time. For those individuals who have not finished the entire withdrawal process within a relatively short study period, it would be very difficult, if not impossible, to validly assess the inter-relationships of the hypothesized turnover predictors that may be unfolding and changing over time. Consequently, the estimated effects of turnover predictors on turnover might be misinterpreted. In sum, arbitrary choice of the study window, along with the limited frequency of measurements, may have contributed to the general lack of empirical consensus about, or possibly misinterpretations of, the effects of various turnover determinants on turnover.

Right censoring

In turnover research, right censoring refers to situations where an employee under observation is no longer observed after a certain period of time, and as a result, the occurrence of voluntary turnover is unobservable for the employee. It can occur when some employees have not yet left their job by the end of the specified study period, or an employee in the study withdraws prematurely, or is lost to follow-up prior to the end of the study period for involuntary or other unknown reasons (Cleves, Gould, & Gutierrez, 2002, p.31).

For instance, when the event of interest is voluntary turnover, the observation of voluntary turnover is right-censored for the employee who left his or her job during the study period for an involuntary reason (e.g., termination). Or, a subject who participates in the study cannot be located after a while for some unknown reasons. The occurrence of voluntary turnover is right-censored for this subject, too. These kinds of right-censored observations have been usually discarded in traditional cross-sectional studies since the main focus is on the occurrence of voluntary turnover by the end of the study window. Another type of right censoring mentioned earlier involves the employees who have not left their job by the end of the study window. In the traditional cross-sectional design, these employees provide no more information than simply being used to distinguish leavers from stayers. However, it should be noted that these stayers can provide a lot more useful information which can be used to uncover temporal patterns of turnover. First, these stayers may have varying levels of tenure. Second, these stayers have not voluntarily left their job up until the end of the study period. Combined together, this information can be used to reveal time-varying turnover patterns. Exclusion of some right-censored observations and inefficient use of information about other types of right-censored observations may also affect the resulting sample size, statistical power, and overall efficiency of statistical analyses. In addition, as pointed out by Peters and Sheridan (1988), different study windows could involve different comparison groups of leavers and stayers, and as a result, could yield different empirical findings. Also, estimated results derived from different study windows would hardly reveal the true relationships between predictors and turnover that might change over time (Porter, Crampon, & Smith, 1976; Sheridan & Abeson, 1983).

In sum, cross-sectional window designs in general suffer from their lack of ability to investigate temporal aspects of different turnover processes. The static nature of traditional research designs is inevitably not well suited to the dynamic nature of turnover processes. In order to better understand voluntary turnover, for instance, we need to investigate not only the occurrence of turnover, but also the frequency or intensity of voluntary turnover at different points in tenure. Information on the frequency and intensity of turnover at different points in tenure can have important theoretical and practical implications.

Left censoring

Left censoring occurs when individuals left their job prior to the start of the study window. In the traditional cross-sectional window design, these individuals are systematically excluded from the study because the sample under study usually consists of current employees at the start of the study window. An important consequence of left censoring is that the tenure distribution of the sample may vary partly as a function of the specific starting date chosen for the study window. For example, the average tenure of a sample will be relatively long if hiring rate was unusually low over an extended period prior to the starting date of the study window, and vice versa. In the former case, low-tenured individuals are systematically excluded from the sample.

This situation creates several potentially serious problems especially in traditional research designs. First, differences in the average tenure across different samples may result in differential turnover rates since tenure is among the strongest, and most consistent, predictors of employee turnover (Allen, Bryant, & Vandaman, 2010; Bauer, Bonder, Erdogan, Truxillo, & Tucker, 2007; Griffeth, Hom, & Gaetner, 2000; Mobley, 1982). Second, as Katz (1978) pointed out, factors affecting turnover may have differing degrees of relevance at different stages in tenure. As a result, for instance, factors influencing short-tenured leavers may be irrelevant for long-tenured leavers. Thus, empirical findings from a sample comprised of relatively short-tenured employees may not be generalized to a group of long-tenured employees. A third problem is that traditional research designs fail to consider the timing of turnover (i.e., no distinction between early- and late-leavers), and therefore cannot detect varying intensity of turnover as well as differing effects of time-variant predictors at different stages in tenure. Finally, traditional research designs ignore the tenure period of each individual at the current job prior to the start of the study window (i.e., left truncation). In general, failure to account for censored observations may result in biased estimates unless censoring is random (Lee, Gerhart, Weller, & Trevor, 2008). In sum, the above problems associated with left censoring may threaten the internal as well as external validity of results in previous studies based on a traditional cross-sectional window design (Sturman, & Trevor, 2001).

METHOD

Sample and measures

The present study uses the data from the National Longitudinal Survey of Youth, 1979 Cohort (NLSY79). NLSY79 is an annual survey (biannual after 1994) of a nationally representative sample of young men and women. The present study uses the data from the 1996 to 2000 surveys which contain specific information on the reasons for voluntary turnover necessary to make a distinction between different types of leavers. The sample used in the

current study consists of the 1996 interviewees who provided information on their current or most recent job (also called a CPS job). A longitudinal employment history for the 1996 CPS job up to the date of the 2000 survey was created for each subject, which contains information on tenure, job satisfaction, wages, working hours, demographics, etc. After excluding respondents who were self-employed, working in a family business, or actively serving in the armed forces, and respondents with missing information, the final sample was reduced to 6,199. Using the information on different reasons for leaving the 1996 CPS job, involuntary and voluntary leavers were identified. Voluntary leavers left their job "to look for a job," "to take another job," "for family reasons," or "for other unspecified reasons. This study focuses on voluntary leavers.

Using a survey question measuring global job satisfaction, "How do/did you feel about your job?" a four-point scale was used: "dislike it very much" (1), "dislike it somewhat" (2), "like it fairly well" (3), "like it very much" (4). Tenure is total tenure in weeks at each reported job. This variable is used as a duration variable (analysis time until turnover) in the survival analyses. Relative pay represents an individual's pay level relative to the average pay level individuals with similar characteristics can expect to earn in the individual's three-digit occupation category, and was created by using the information on hourly pay in the NLSY and the Current Population Survey. Work hours are usual weekly work hours at the job. Total number of jobs represents total accumulated number of jobs a respondent has held during his/her working career. Education level is the highest grade completed. Sex was coded 1 for male, 2 for female. Race was coded 0 for non-white, 1 for white. Marital status was coded 0 for non-married (i.e., never married, divorced, separated, etc.), 1 for currently married. Age is a continuous variable as of each interview date.

Analytical methods

Given the methodological problems with the cross-sectional window design, researchers have called for alternative methodological approaches to turnover research, and suggested survival analysis of "time until turnover" as a promising alternative to traditional research designs and analytical methods (Morita, Lee, & Mowday, 1989, 1993; Peters & Sheridan, 1988; Singer & Willett, 1991; Somers & Birnbaum, 1999). From a conceptual and statistical point of view, traditional analytical methods such as ordinary-least-squares (OLS), logistic, or probit regressions are not very effective in answering questions like "what is the probability of turnover at a specific point in tenure?, or " how are early leavers different from late leavers?" OLS regression is statistically less appropriate than other analytical methods (e.g., logistic or probit regression) in analyzing a binary dependent variable such as turnover (Maddala, 1983). Although logistic or probit regression is better suited than OLS for handling a binary outcome variable, neither one is fully capable of analyzing time-varying covariates and temporal aspects of turnover.

The main advantage of survival analysis over other analytical methods stems from the fact that time is incorporated into the analysis as an integral part since survival analysis is essentially the analysis of durations or spell lengths until the occurrence of an event of interest (e.g., tenure until voluntary turnover) (Cox & Oakes, 1984; Kalbfleisch & Prentice, 1980). As a result, survival analysis can simultaneously handle both the occurrence of turnover and the timing of it. Coupled with visual graphical representations, survival analysis can provide more detailed information about the varying intensity of turnover over time and the relationships between turnover and predictors. Another appealing feature of survival analysis is that it can utilize censored observations. In sum, survival analysis can utilize available information more

efficiently, and lessen serious methodological problems associated with traditional turnover research methods. (Morita, Lee, & Mowday, 1989). Following the lead of Somers and Birnaum (1999), the present study uses OLS, logistic regressions, and a semi-parametric hazards model, known as a Cox regression model, to analyze the data (Cox, 1972). For OLS and logistic regression analyses, only the first observation for each subject was used to measure the values of the predictors to emulate the traditional cross-sectional window design. But, multiple observations for each subject were used in the proportional hazards regression analyses.

RESULTS

Table 1 presents means, standard deviations, and correlations among the study variables. Table 2 shows that during the study period, more than half of the sample left their job for either involuntary or voluntary reasons. Table 3 summarizes the estimates from OLS, logistic, and Cox regressions. The effect size of the coefficients is not comparable across three analyses since the coefficients of these three regressions have different interpretations, but the direction of the effect of covariates can be meaningfully compared. In addition, as Somers and Birnaum (1999) pointed out, it should be noted that "OLS estimates with a binary, skewed dependent variable such as turnover are highly likely to be biased" (p. 278).

Three regression analyses produced substantially different results. In both OLS and logistic regression analyses, job satisfaction and relative pay level were negatively related to voluntary turnover, and total number of jobs and sex (higher turnover risk for women) were positively related to voluntary turnover. Hours worked was significant and positively related to voluntary turnover only in the logistic regression analysis. Overall, some results from OLS and logistic regression analyses were consistent with previous research (e.g., Allen, Bryant, & Vandaman, 2010). Findings from the Cox proportional hazards regression were markedly different from those from OLS and logistic regression analyses. As in the logistic regression, job satisfaction, relative pay level, total number of jobs, work hours, and sex were found to be a significant predictor of voluntary turnover. However, age and education level also emerged as a significant predictor of voluntary turnover. Previous research has consistently found that the likelihood of voluntary turnover decreases with age, though mixed results have been found for education level (i.e., a weak predictor of voluntary turnover). An exponentiated individual coefficient has the interpretation of the change in the turnover hazard rate caused by a one-unit change in the corresponding covariate. For example, one unit decrease in job satisfaction increases the turnover hazard rate by 38% (Exp(-.48)=.62). Finally, Figure 1 shows Kaplan-Meier survival function which represents the probability of survival (i.e., no turnover) beyond a specific point in tenure. Figure 2 graphically illustrates the estimated hazards rates of voluntary turnover. In particular, it clearly shows the varying intensity of voluntary turnover over the course of tenure. Consistent with previous research using survival analysis techniques, hazard rates increase early in tenure, and begin to monotonically decrease over the later stage of tenure (Lee et al., 2008; Morita, Lee, & Mowday, 1989, 1993).

DISCUSSION

In response to pervasive criticism over inherent flaws in traditional turnover research methodologies, new methodological approaches have been proposed. Since the introduction of survival analysis into turnover research in the late 80's, survival analysis has been gaining

popularity among turnover researchers as a promising alternative to traditional methodologies mainly because of its ability to handle temporal aspects of turnover over time. It is conceptually and practically very important to understand not only "why," but also "when" employees leave their job. Survival analysis thus has a clear advantage over traditional methodologies in that it analyzes turnover behavior in terms of "duration until turnover", and not a simple binary distinction between stayers and leavers. The present study clearly demonstrated the above point by showing temporal patterns of turnover intensity over tenure in Figure 1. Nonetheless, it would be premature to conclude that survival analysis has an absolutely universal advantage over traditional methodologies for several reasons. First, over recent years, an increasing number of turnover studies have used survival analysis techniques, but there are still too few empirical studies using survival analyses for us to draw a definitive conclusion about the utility of survival analysis. The second reason concerns the question of whether different methodologies produce different findings, for instance, about the effects of a variety of turnover predictors on turnover. It seems that existing empirical research does not provide a definitive answer to this question. For instance, while some studies found results consistent with those from studies using traditional methods, some others did not (e.g., Daren, Hampton, & Boatright, 1987; Dickter, Roznowski, & Harrison, 1997; Lee et al., 2008; Somers & Birnbaum, 1999). As discussed in the previous section, the present study also found some similarities as well as divergences in results across different analytical methods. Though unreported, OLS and logistic regression analyses which included a tenure variable with other variables were also conducted. Results indicated that including tenure in the analyses did not significantly alter the results in both OLS and logistic regression analyses. Lastly, even among a limited number of studies using survival analysis, empirical findings from different studies are not completely comparable because of differences in model specification, methodology, sample/predictors used, etc.

To the extent that divergent patterns of empirical findings across different methodologies are validated, new perspectives on employee turnover can be obtained by pursuing new conceptual and/or methodological approaches. Though existing research found some preliminary evidence supportive of the utility of new methodological approaches such as survival analysis, it is still too early to make any definitive conclusions about the implications of these preliminary findings. In order to gain further insights into employee turnover behavior, as Somers and Birnbaum (1999) pointed out, it is essential to accumulate more empirical research comparing results from traditional and new approaches. In addition, more research effort needs to be directed to integrating a variety of conceptualizations of turnover behavior.

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Appendix

Table 1. Means, Standard Deviations, and Correlations

	Mean	S.D.	1	2	3	4	5	6	7	8
1. Job satisfaction	3.29	.74								
2. Relative pay	1.07	.64	**.08**							
3. Total jobs	9.70	5.46	**-.05**	**-.07**						
4. Work hours	40.68	10.72	.01	**.35**	.01					
5. Sex	1.49	.49	.01	-.01	**-.08**	**-.30**				
6. Age	36.15	2.79	**.02**	**.03**	**-.15**	**.03**	.01			
7. Race	.66	.47	**.04**	**.05**	**.05**	**.02**	**-.02**	**.02**		
8. Married	.57	.49	**.07**	**.05**	**-.10**	-.00	**-.05**	**.07**	**.23**	
9. Education	13.23	2.38	**.06**	**.04**	**.06**	**.02**	**.06**	**.04**	**.10**	**.10**

Note: n=14,362 is larger than the original sample size because of multiple observations for each subject.
Correlation coefficients significant at the 5% level or better in bold.

Table 2. Turnover Summary: n=6,199

Stayers	3014 (48.6%)
Leavers	
Involuntary turnover	872 (14.1%)
Voluntary turnover	2,313 (37.3%)

Table 3. OLS, Logistic, and Cox regression results

	OLS		Logistic		Cox	
	b	***s.e.***	***b***	***s.e.***	***b***	***s.e.***
Job satisfaction	-.07**	.07	-.51**	.05	-.48**	.02
Relative pay	-.03**	.23	-.47**	.09	-.46**	.05
Total jobs	.01**	.00	.06**	.01	.05**	.00
Work hours	.00	.00	.01*	.00	.01**	.00
Sex	.03**	.01	.33**	.08	.26**	.04
Age	-.00	.00	-.02	.01	-.21**	.05
Race	-.00	.01	-.04	.08	-.04	.05
Married	.01	.01	-.11	.08	.06	.04
Education	.00	.03	-.00	.02	-.02*	.01
Adjusted R^2	.05**					
Log likelihood			-2256		-15783	
Log likelihood-ratio (χ^2) test			278.16**		10009.59**	

Note: n=6,199 for OLS and logistic regression, n=14,362 spells for the Cox regression.
b: Coefficients. ***s.e.***: Standard errors. **, * Significant at the 1% and 5% level, respectively.

Figure 1. Kaplan-Meier Survival Function

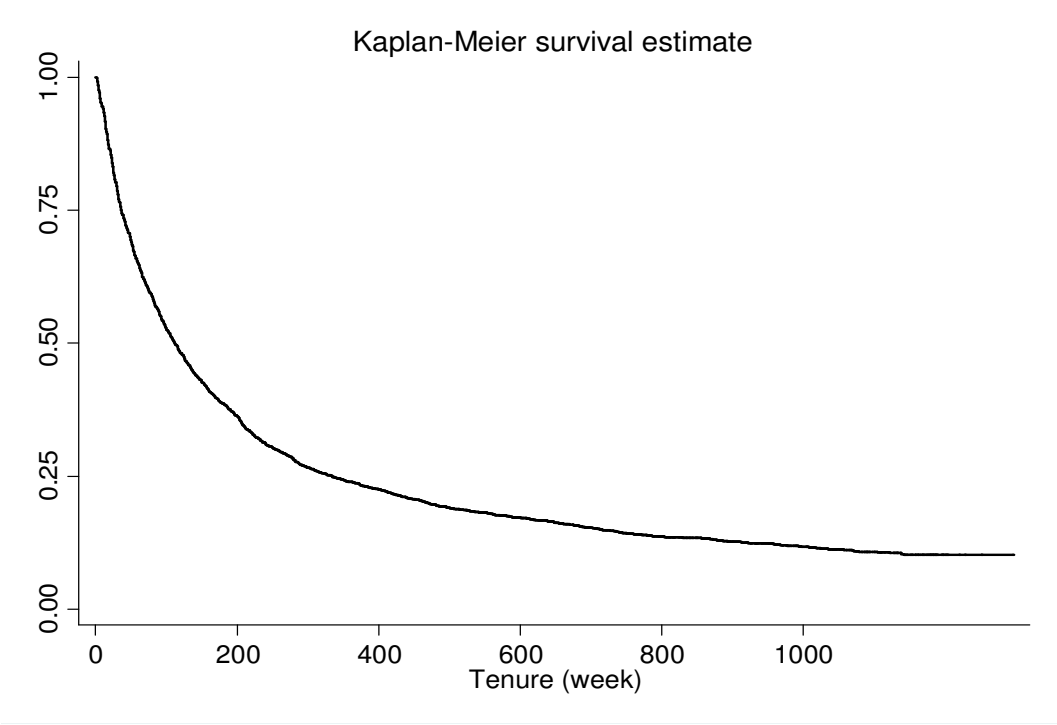

Figure 2. Turnover Hazard Rates