TEMPORAL PATTERNS OF RESPONSE ERRORS IN RETROSPECTIVE REPORTS OF UNEMPLOYMENT AND OCCUPATION

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Introduction

This paper examines the validity of reports of a time series of events or statuses of individual respondents. In contrast to most past validation studies that have focussed on the accuracy of the reporting of a single past event, we investigate whether the respondent's status is accurately reported in each month of a thirty-month period. Our specific subjects are unemployment and occupational status. For each respondent in our sample we are able to assess the accuracy of reports of unemployment and occupational position in each of the thirty months prior to the interview.

Model of Reporting Error

Past work (e.g. Bradburn and Sudman, 1979; Cannell, et al., 1965) suggests that time, salience and task factors may all affect response error. Demographic measures have also been shown to be predictive of such error, but there has been no clear recognition of why certain demographic groups show higher or lower rates of error.

Our general model is:

$$(1)\quad Error_{it} = f(Time_{it}, Salience_{it}; Task_i, Demog_i) + e_{it}$$

where $Error_{it}$ = Probability that individual i gives an erroneous report of his or her status at time t

$Time_{it}$ = Amount of time that has elapsed between t and the date of individual i's interview

$Salience_{it}$ = Measures of the psychological importance of the status at time t for individual i

$Task_i$ = Measures of the overall reporting task facing individual i

$Demog_i$ = A set of demographic measures characterizing individual i

The error term e_{it} is assumed to have zero mean and constant variance. For reasons explained below, we cannot assume that $cov(e_{it}) = 0$. It is likely that f is neither linear nor additive. Past research suggests that error rates are exponential functions of time and that the pattern of time "decay" may interact with the salience of the event that is being recalled and the overall reporting task facing the respondent. We allow for these patterns by using flexible functional forms relating time, salience, and task measures to response error and by investigating a number of possible interactions among these factors.

Research Design

The data presented in this paper are part of a larger validation study designed to assess the quality of data obtained in the Panel Study of Income Dynamics (Duncan and Mathiowetz, 1984). Respondents were selected from the personnel records of an older manufacturing company with several thousand employees. The hourly work force for this company is completely unionized and none of the workers, hourly or salary, work part time. The company work force is considerably older (with more job tenure) than would be true of a national sample of workers, due to recent layoffs and few new hires in the past two years. These deviations were offset by the sampling procedure that stratified the employee list by age and type of worker (hourly vs. salary) and selected a greater proportion of younger and salaried workers. The overall response rate for the study was 78.3%.

Methods

Respondents were asked to recall months in which unemployment occurred and to report occupational changes for a thirty-month period from January, 1981 to June/July, 1983[1]. Detailed employee records covering the same reference period permitted precise measurement of the validity of the report of each month's status given by each respondent.

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[1]Months of unemployment were reported in the interview in response to the questions: "Were there any periods since the beginning of the year before last, January, 1981, when you were unemployed and looking for work or temporarily laid off for a week or more?" "What month(s) and year(s) (was that/were those)?" "Any other such periods?" "Were there any periods since the beginning of the year before last, January, 1981, when you were completely out of the labor force, that is, neither unemployed nor temporarily laid off nor looking for work for a week or more?" Occupation at the time of the interview was reported in response to the question sequence, "What is your main occupation? What sort of work do you do?" "What are your most important activities or duties?" Tenure in current position is determined by the response to the question, "We have asked about your work hours and current job, but we also need to know about any changes in your employer or in your title or position -- what you do. In what year did you start working in your current position with your present employer?" As long as the response to that question was later than January 1, 1981, additional questions about occupation and tenure were asked to establish the occupational history back to January 1, 1981.

In order to estimate the model given in equation (1), each monthly observation was treated as a separate case, a procedure which resulted in approximately 12,000 observations (from 387 individual respondents x 30 months). Some of the explanatory variables are specific to the given month, some are formed from information from the same individual regarding adjacent months, and some (such as the demographic and overall task difficulty measures) are specific to the individual and identical for all months of data for a given individual.

Response error for unemployment status in a given month was defined as existing if either (1) the company record showed at least one week of unemployment for that particular month and the respondent reported none; or (2) the company record indicated no unemployment and the respondent reported some unemployment in that month. This procedure ignores response error in the respondent's dating within a month; a more detailed comparison was not feasible. For this analysis, no distinction is made between over- and underreports.

Errors in reports of occupation were determined by a direct comparison of the company record with the interview report. Instead of independently coding the company record and the interview, coders were trained to assess whether the two sources of information were consistent. Thus the comparison is not plagued with error resulting from erroneous or inconsistent 3-digit Census occupation coding. As with unemployment, the measure of error in the occupational report is dichotomous.

The problem posed by the possible non-independence of errors for the thirty months of reports by each respondent is analogous to the problem posed when sample cases are clustered into geographic concentrations that may be more homogeneous than would be the case if the sample were drawn completely at random. In our case, the thirty-month clusters for each respondent are completely homogeneous for characteristics such as demographic measures that are invariant over the thirty months. Other measures included in the response error models are specific to the month and should show much less homogeneity. Some variables, such as the dummy variable measures of time between the given month and the interview will actually have a negative covariance within each respondent "cluster."

Estimates of the sampling errors of the means of the independent variable and of the coefficients of the regression are obtained by forming 382 jackknife replications of the sample and then calculating the variance of the coefficients across all replicates.

Error Rates by Time Since Event

Figures 1 and 2 present the error rates in reports of unemployment and occupation by number of months between interview and month for which unemployment or occupational status is being reported for all respondents and the subsample of respondents for whom company records showed at least one unemployment spell or one occupation change, respectively. The increase in the difficulty of the reporting task for those with at least one episode of unemployment or position change within the past thirty months is well illustrated in the higher error rates for each respective subgroup although the overall pattern does not conform to the exponential memory decay function hypothesized in the literature.

Measures of Salience and Task Difficulty for Unemployment Response Error Analysis

The unusual pattern of unemployment response errors presented in Figure 1 suggests that factors unrelated to length of recall period may account for response error. The set of salience, task, and demographic factors included in our models are spelled out below.

Salience. Two measures of the saliency of the given month's employment status are included in the analysis of error in reports of unemployment. The first is the actual amount of unemployment in the given month as revealed in the company records. We hypothesize that the response error rates would be least for those with no unemployment in a particular month and for those who were unemployed the entire month and highest for reports on months for which company records showed that the respondent had some but not complete unemployment. To allow for this nonlinearity, we use a piecewise linear function ("spline" function) with differently sloped segments for 0-1 weeks of unemployment and 2-4 weeks of unemployment.

A second set of measures of the likely salience of unemployment status in a given month concerns the timing of the spell of actual employment or unemployment in which that month is embedded. By "timing" we mean whether an unemployment spell begins or ends in that month or whether an individual is in the middle of either an extensive period of either continuous employment or unemployment. The beginnings or endings of unemployment spells are important events in most life-event scales--and therefore ought to be highly salient. As a result, unemployment status ought to be more accurately reported in those cases than the middle of unemployment spells.

The beginning, end and midpoints of unemployment spells were determined by summarizing the unemployment experience according to the company record of an individual over 3 months--the given (t), previous (t-1) and subsequent months (t+1). Five categories were formed: (1) no unemployment during the 3 months; (2) month t begins an unemployment spell; (3) month t ends an unemployment spell; (4) unemployed all three months; and (5) mixture of unemployment spells over the three months. The first four categories are self-explanatory; the last refers to an odd three-month unemployment history, for example, when an individual is

unemployed for 2 weeks in each of the three months. Because this last group has no definite pattern of unemployment spells (e.g. no clear beginning or ending date), months which are embedded in such spells should be plagued with the highest levels of response error.

Task. Research in cognitive psychology suggests that recalling a specific event is more difficult for those who have experienced several related events. Therefore, we would expect poorer reporting from respondents with several different unemployment spells than those with only one spell. Respondents who had been fully employed for the 30-month recall period face the easiest reporting task. The task becomes more difficult for those with a single unemployment spell, and more difficult for those with multiple spells. As the number of months of actual unemployment increases, the level of response error should rise monotonically although perhaps not linearily. To allow for an incremental effect on response error of the first month of actual unemployment that is greater than the effect of subsequent months, a spline function that allows for different sloped segment of 0-1 months and 2 or more months of actual unemployment is used.

Demographic Factors. Findings from both experimental and survey studies suggest that response error increases with age and for black respondents and is lower for women and the higher education groups. By including them in our error model, we will be able to ascertain to what extent they act as proxy measures of the potentially more important salience and task factors.

Time Between Interview and the Given Month. Five dummy variables, each representing a six-month segment, are included to show the effects of the elapsed time between interview and the month of interest. The coefficients on these dummy variables represent the average difference in response error between the given six-month segment and the omitted category, 0-5 months. The dummy variables are used to permit the greatest flexibility in the functional form of temporal effects.

Estimates of Models of Error in Reports of Unemployment

Table 1 presents coefficients for two regression models of errors in reports of unemployment. The first column shows the regression estimates of a model with the time segments and demographic measures. Estimates from the jackknife replications on the extent to which the standard errors are multiples of the corresponding sampling errors that would be obtained under the assumption of simple random sampling are presented in the column labeled "DEFT".

Coefficients on the time dummies in the first column reflect the pattern evident in the graph--average error rates for the second six months are significantly higher than for the first six months, while error rates for the more distant recall periods are actually lower than for the first six months. Among the demographic measures, the negative sign of the coefficient for age contradicts previous findings, but the other coefficients are consistent.

The regression coefficients for the full model of equation 1 are presented in column 3 of Table 1. The saliency measure of the actual amount of unemployment for the given month, the measure of the overall task difficulty facing the respondent, and the pattern of unemployment for adjacent months are added in this model. As a whole, the additional measures are powerful predictors of reporting error; the R^2 jumps from .039 without them to .532 when they are included. Both segments of the unemployment intensity spline function are highly significant and follow the hypothesized direction. Both segments of the task difficulty measure are positive although not statistically significant at conventional levels. Coefficients for the dummy variables representing the timing of unemployment spells show that respondents with no unemployment in the three-month interval bracketing the given month report most accurately, followed by those who are unemployed throughout the entire three month period. Significantly higher response errors are found for individuals who are beginning or ending spells or who have a mixed pattern of unemployment over the three months.

The addition of the saliency and task measures has a dramatic effect on the coefficients of the demographic and the time variables. The anomalous age effect and the effect of education are no longer significant, suggesting that the higher reporting error rates for the young and for the more highly educated are due to the more difficult reporting task they face and the differential salience of their patterns of actual unemployment. The anomalous simple relationship between time and response error shown in the first column disappears for the most part. All time dummies are positive although none are statistically significant at conventional levels and the temporal pattern of error rates is still not monotonic.[2]

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[2] An investigation of alternative functional forms produced no statistically significant interactions between time and the saliency and task measures. A preliminary logistic regression on the full model produced coefficient estimates that were identical in sign and relative consistent in level of statistical significance with the linear probability model estimates given in Table 1.

Measures of Saliency and Task Difficulty for Occupation Reporting Error Analysis

The measures of salience and task difficulty used in the models of error in reports of occupation parallel those used for unemployment.

Salience. Two measures of likely salience of the month for which occupation is reported were developed, one summarizing the timing of occupation changes for the given(t), previous(t-1), and subsequent(t+1) months, and a second measuring for changes in salary accompanying occupation changes. As with unemployment, five dummy variables were formed from company record information to assess the timing of occupation changes; (1) no occupation change in the 3 months; (2) respondent begins a new occupation in month t; (3) respondent ends an occupation in month t; (4) respondent began a new occupation each month (t-1 through t+1); and (5) mixture of occupation changes during the three months. Changes in salary in either direction of 10 percent or more in the given month were also hypothesized to affect response error. Changes in salary can be thought of as representing the likely salience of the event or its social desirability.

Task. Task difficulty for reporting occupation changes is measured in an analogous way to the task measure used in the analysis of unemployment response error. It is also a spline function, allowing for differently sloped segments for 0-1 and 1 or more occupation changes over the thirty-month period.

Table 2 presents the coefficients for the regression of errors in reports of occupation on two sets of explanatory variables. The first model, which includes the dummy variable for time between the given month and the interview and the demographic measures reflects the description presented in Figure 2. Error rates are uniformly higher when the given month was more than five months before the interview but show no evidence of rising further with relative time. In sharp contrast to temporal patterns of response error for unemployment, the temporal pattern of response error for occupation is unaffected by the addition of demographic, saliency or task factors.

As with unemployment errors, reports by older individuals were more accurate. No other demographic variables were statistically significant.

Estimates of the full model shows that the measure of the total number of actual position changes over the thirty months shows a more powerful nonlinear effect on response error as did the analogous task difficulty measure in the unemployment response error analysis.

Added to the timing and demographic measures in the final model are the two saliency measures, timing of occupation change and changes in salary. The effects of the timing of the occupation report are not as striking as those for error in reports of unemployment. Only the last two categories, identifying months embedded in spells of new occupations each month and of a mixture of occupation changes, are associated with higher rates of response error. Neither an increase or decrease in salary significantly affect the level of response error.[3]

Conclusion

This paper has used data from a validation study in an attempt to assess the relative importance of salience, task, and time factors in producing response errors. Our two different subjects, unemployment and occupational position, were analyzed in similar ways and produced many similar results and a few notable different ones as well.

We found that time was not the most important factor in producing response errors. Of considerably greater importance were a set of measures that reflected the likely salience of the events of the particular month that was being reported on.

Also of interest are our results on the demographic correlates of response error. We found that the explanatory power of the demographic variables was substantially reduced when the effects of salience and task measures were taken into account, suggesting that response errors differ across demographic subgroups because those subgroups have different experiences that make it more or less difficult for them to report accurately about them.

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[3] An investigation of possible interactions between time and the saliency and task measures in the occupation regressions showed that none were statistically significant at conventional levels. Estimation of a logistic form of the regression model did not alter any of the basic conclusions.

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FIGURE I

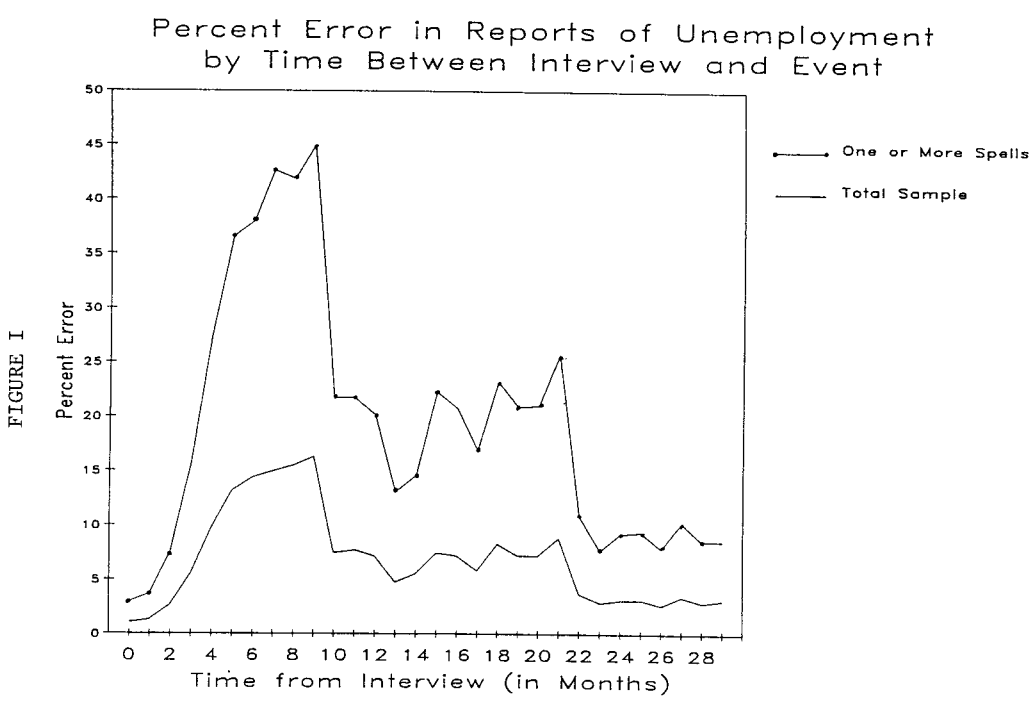

TABLE 1. Regression Coefficients and Standard Errors for two Models of Reporting Error for Reports of Unemployment

	Model 1			Full Model		
Time between Event & Interview	Coefficient	Standard Error	DEFT	Coefficient	Standard Error	DEFT
0-5 months	--			--		
6-11 months	.043**	(.010)	1.33	.010	(.007)	1.30
12-17 months	-.009	(.011)	1.41	.005	(.007)	1.26
18-23 months	-.002	(.011)	1.49	.008	(.007)	1.66
24-29	-.035**	(.011)	1.33	.007	(.006)	1.14
Demographic Variables						
Age	-.004**	(.001)	2.68	-.000	(.001)	1.66
Whether black	.022	(.025)	3.02	.008	(.010)	1.82
Whether female	-.018	(.026)	2.78	-.014	(.017)	2.62
Education	-.011**	(.003)	2.22	-.001	(.002)	2.07
Intensity of Unemployment for Current Month[1]						
0-1 segment				.686**	(.060)	3.46
1+ segment				-.080**	(.021)	3.65
Total Months with Unemployment[2]						
0-1 segment				.014	(.016)	2.98
1+ segment				.003	(.004)	5.19
Timing of Spells[3]						
No unemployment				--		
Begin unemployment				.106*	(.044)	2.06
End unemployment				.051*	(.019)	1.52
Continuous unemployment				.003	(.079)	3.52
Mixture of unemployment				.047*	(.022)	1.61
Adjusted R^2	.039			.532		

[1]Intensity of unemployment for current month is based on record report of amount of unemployment for that month. A spline function allowing for differently sloped segments for 0-1 weeks and 1-4 weeks of unemployment was used.

[2]Total months with unemployment is based on the record report of the number of months with any unemployment during the 30-month recall period. A spline function allowing for differently sloped segments for 0-1 months and more than one month of unemployment was used.

[3]Set of dummy variables was formed from record information about unemployment in the past, current, and subsequent months. Coefficients represent deivations from omitted category, "no unemployment in three months."

Source: PSID Validation Study

* $p \leq .05$
** $p \leq .01$

FIGURE II

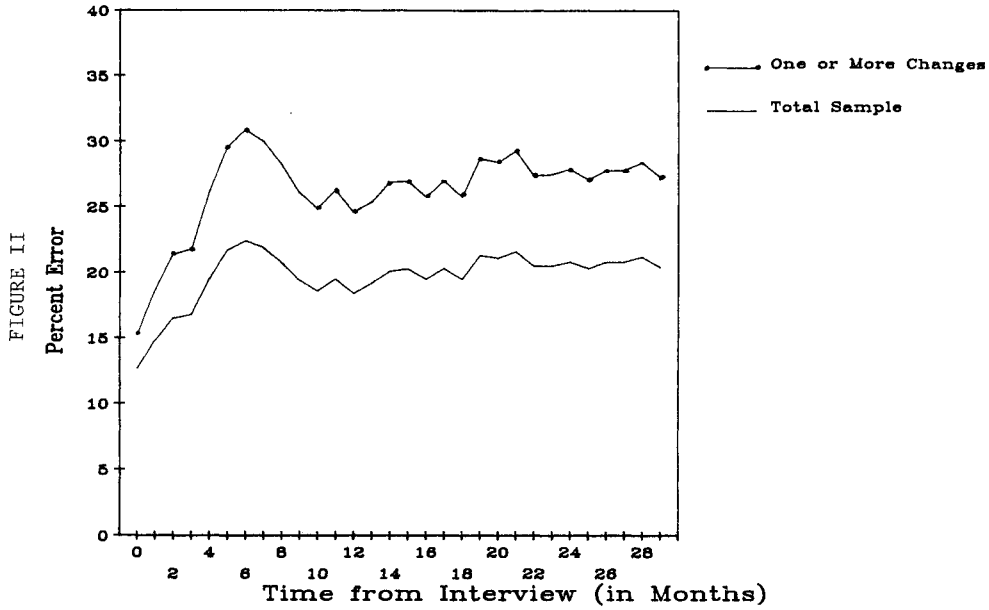

TABLE 2. Regression Coefficients and Standard Errors for Two Models of Reporting Error for Reports of Occupation

	Model 1			Full Model		
Time between Event & Interview	Coefficient	Standard Error	DEFT	Coefficient	Standard Error	DEFT
0-5 months	--			--		
6-11 months	.035**	(.012)	0.98	.027*	(.012)	1.01
12-17 months	.026	(.014)	1.14	.020	(.014)	1.13
18-23 months	.037*	(.015)	1.29	.029	(.016)	1.31
24-29 months	.038*	(.016)	1.37	.032	(.017)	1.35
Demographic Variables						
Age	-.006**	(.001)	3.70	-.003	(.001)	3.48
Whether black	.050	(.058)	4.64	-.010	(.054)	4.34
Whether female	.040	(.077)	5.21	.081	(.074)	5.01
Education	-.005	(.008)	4.32	.003	(.008)	4.26
Total Months with Occupation Change[1]						
0-1 segment				.103**	(.039)	4.29
1+ segment				.020**	(.007)	4.68
Timing of New Occupation[2]						
No change				--		
Begin new occupation				-.005	(.025)	1.27
End occupation				.013	(.019)	1.12
New occupation each month				.064**	(.018)	1.85
Mix of new occupations				.129**	(.060)	1.67
Changes in Salary[3]						
No change				--		
Decrease in pay				-.019	(.019)	.824
Increase in pay				-.008	(.022)	.955
Adjusted R^2	.009			.099		

[1]Total months with occupation change based on record information concerning the number of months during the 30-month recall period in which the respondent had at least one occupation change. A spline function allowing for differently sloped segments for 0-1 and 1+ occupation changes was used.

[2]Set of dummy variables was formed from record information about occupation changes in the past, current, and subsequent months. Coefficients represent deviations from the omitted category, "no change in occupation for the 3 months."

[3]Set of dummy variables was formed from record information about changes in salary (increase or decrease) of 10% or more. Coefficients represent deviations from omitted category, "no change."

Source: PSID Validation Study

* $p \leq .05$
** $p \leq .01$