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ABSTRACT

The Methods Test Panel (MTP) was a study undertaken by the Census Bureau to assess alternative survey methods for the Current Population Survey (CPS). Analysis of the MTP suggests that the mode of interview--telephone vs. personal visit--affects employment status. A similar effect is apparent for the respondent rule. The pattern of the rotation bias not only differs from the CPS pattern, but varies across regions. It is possible that the true causes of rotation bias are complex cultural factors for which location is a proxy. To test this idea, further examination of the CPS is warranted.

INTRODUCTION

Biases from a variety of sources affect the quality of survey data. In particular, alternative survey methodologies can lead to different estimates for the parameters of concern. As a way of assessing competing techniques and their effect on the Current Population Survey (CPS), the Census Bureau has undertaken a study known as the Methods Test Panel (MTP).*

Previous analysis of the MTP data considered the unemployment rate and its relation to the survey method tested.[5],[8] A major difficulty encountered in the earlier analyses was the highly discrete nature of the data. The study was planned as a fully balanced split-plot experiment, which could be analyzed via the appropriate linear model. When this approach was tried on the unemployment rate, the distributional properties of the data thwarted the analysis.

METHODS TEST PANEL

The MTP focuses on four aspects of data collection procedures: 1) rotation group bias; 2) the effect of continued interviewing by the same interviewer; 3) mode of interview (telephone vs personal visit) and 4) type of respondent. These experimental treatments were chosen for study because of interest in both their direct effects and possible interactions.

Once a household is selected for the survey, it is interviewed four times in consecutive months and the set of households which receive initial interviews in a given month is called a rotation group. The use of rotation groups permit individuals to be examined over time as a way of exploring the dynamic behavior of the labor market. Evidence suggests that responses vary with repeated interviewing, a phenomenon known as rotation group bias or time-in-sample bias. [1]

The rotation group pattern of the MTP differs slightly from that of the CPS.[3],[4] Members of a given rotation group are interviewed in four consecutive months and then retired permanently, rather than adhering to the 4-8-4 scheme of the CPS. While this arrangement limits the analysis, the reduced start-up time was more desirable.

The effect of continued interviewing is studied by examining two treatments. Half of the units in the sample are enumerated by the same interviewer each month, while interviewers change each month for the other sample units. It was thought that rotation group bias may arise from the conditioning effect of repeated interviewing and the comparison of these two treatment groups may account for some of the bias ascribed to the rotation groups.

Evaluation of the mode of interview presents a special difficulty. The interviews for the CPS are carried out both by phone and in person. Differences in response rates and coverage may arise from this practice and introduce biases into the data.[6],[13] The initial interview for each unit must be obtained by personal visit, since telephone numbers are not available when units are first designated for enumeration. Consequently, all first-month interviews are done in person while subsequent interviews are divided evenly between telephone and personal visit. This arrangement of treatments partially confounds the effects of interviewer mode and time in sample.

*The Methods Test Panel has been renamed Phase I of the Methods Development Study.

The respondent rule used in the CPS is that one person in each household is designated as the respondent and all subsequent questions are directed to that person. Since the respondent is generally the person who answers the door or telephone, there is no guarantee that the most knowledgeable member of the household is interviewed.

Three types of respondent were examined in the MTP. The first approach is to designate a responsible adult, generally the person answering the door, as the respondent for the household, as is the procedure currently used in the CPS. A second approach is to randomly designate a different household member each month as the respondent. The third approach is self-response, in which each eligible household member is interviewed individually. Deviations from the assigned respondent pattern were permitted in the MTP only to obtain an interview which would be otherwise lost.

Because of funding considerations, only four regions were selected for the MTP: Los Angeles - Long Beach, California SMSA; Chicago SMSA; Lackawanna County, Pennsylvania; and Macon, Dooly and Houston counties in Georgia. These areas provide a mix of urban and rural households. Within each region individual households were selected by cluster sampling, to obtain eight replicates of all twelve treatments. Thus, within each region, every combination of month in sample, respondent rule, interviewer type and mode of interview was repeated eight times.

ANALYSIS OF THE DATA

The discrete nature of the MTP data lends itself use of categorical data methods. The log-linear model is capable of handling the general types of analysis appropriate to the MTP. [2] To apply the log-linear model to the MTP, persons were classified according to the variables of interest and the model was fit to the resulting table of counts. For example, to study labor force participation, respondents were classified as being in the labor force or not in the labor force. These respondents were also cross-classified by rotation group, mode of interview, type of respondent, etc. The effects of the different survey methods on labor force participation can be assessed via the interaction terms in the model.

The existence of certain terms in the hierarchical model is usually tested by the appropriate chi-square statistic. Unfortunately the asymptotic theory of such tests rests on assumptions about the sampling distribution of the original data. The standard assumption that

data are drawn independently from either a Poisson distribution, a multinomial distribution or a product-multinomial distribution may be unreasonable since the MTP data were gathered through a multi-stage cluster sample.

Several articles have discussed the problems related to chi-square tests when the data are drawn from a complex survey. [9],[14],[15],[16],[17] The survey design generally affects the covariance structure of the estimated cell probabilities. If the covariance structure is ignored and the usual chi-square statistic χ^2 is computed, we find that

$$\chi^2 \sim \sum_{i=1}^{k-1} d_i Z_i^2$$

where $Z_1, Z_2, \dots \sim$ i.i.d.N (0,1) and the d_i are the design effects, i.e., the ratio of the variance of the estimated parameter in the complex survey to its variance under simple random sampling.

ANALYSIS OF EMPLOYMENT STATUS

Employment status, defined as whether an individual is employed, unemployed or not in the labor force, varies with the month in sample, mode of interview, respondent rule and geographic area. This finding is based on the log-linear model for all of the MTP data. Surprisingly, there were no significant interaction terms involving the month in sample, employment status and any of the three survey methods. This fact suggests that rotation group bias is not attributable to any of the three treatments. Regional differences in the rotation bias pattern indicate that it varies widely by location. It is possible that rotation group bias depends on social and cultural factors for which location is a crude proxy.

The log-linear model used for most of the analysis cross-classified the data by employment status, geographic area, mode of interview, respondent rule, type of interviewer and month in sample. Various interaction terms in the model indicate the relationship between employment status and the other variables. The model contains significant interactions between employment status and region, employment status and mode of interview, and employment status and respondent rule. The statistical significance is judged by the standard chi-square tests, and the complex sampling procedures may affect the true significance levels of these tests. Nevertheless, the results suggest aspects of the survey procedure which may affect the employment status observed.

REFERENCES

The mode of interview--phone or personal visit--yields different unemployment rates and labor force participation rates and these rates differ across geographic region. In particular, telephone interviewing produces a higher unemployment rate than personal visits (table 1).

The respondent rule also shows a significant interaction with employment status. The three categories of household respondent, designated respondent and self response exhibit different employment rates (table 2). The analyses suggest that a higher unemployment rate will be realized when the interviews are conducted using the household respondent rule.

The rotation bias in the MTP is also interesting. Most notable is that the subset of the MTP data which most closely resembles the CPS (in terms of mode of interview, respondent rule, etc.) has a very different rotation bias pattern than the CPS. More importantly, this pattern is not stable across geographic region (figures 1 and 2).

When the entire MTP data set is examined, the story changes somewhat. There is no significant interaction between the month in sample and the employment status, implying that rotation bias is not present. However, there is a difference in the pattern when examined on a regional basis (table 3). These findings suggest that rotation group bias varies according to region. It is likely that the real sources of rotation group bias are social and cultural values which correspond roughly to the four regions.

Future research should address the geographic differences in the CPS. It would be interesting to extract the subset of the CPS for the four regions corresponding to the MTP and examine the rotation bias. Furthermore, it would be valuable to examine the region differences in the CPS as a whole.

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TABLE 1. EMPLOYMENT STATUS BY MODE OF INTERVIEW

REGION	UNEMPLOYMENT RATE		LABOR FORCE PARTICIPATION RATE	
	VISIT	PHONE	VISIT	PHONE
Georgia	9.7	10.4	63.5	62.1
Chicago	8.5	7.9	66.3	64.3
Los Angeles	6.2	6.3	66.1	64.9
Pennsylvania	7.2	7.4	58.4	58.3
TOTAL	7.7	8.2	63.5	62.4

TABLE 2. RESPONDENT

	EMPLOYMENT	UNEMPLOYMENT	NILF*	TOTAL
Household	10,491	950	6,827	18,268
Designated	10,607	863	6,823	18,293
Self	10,665	934	6,679	18,278

*NILF = Not In Labor Force

TABLE 3. ROTATION BIAS: UNEMPLOYMENT RATES BY REGION

REGION	MONTH BY SAMPLE			
	1	2	3	4
Georgia	10.2	10.0	10.5	9.7
Chicago	8.1	8.1	8.2	8.6
Los Angeles	5.7	7.1	6.9	6.9
Pennsylvania	7.0	7.2	5.7	7.1

FIGURE 1: Rotation Bias in MTP and CPS

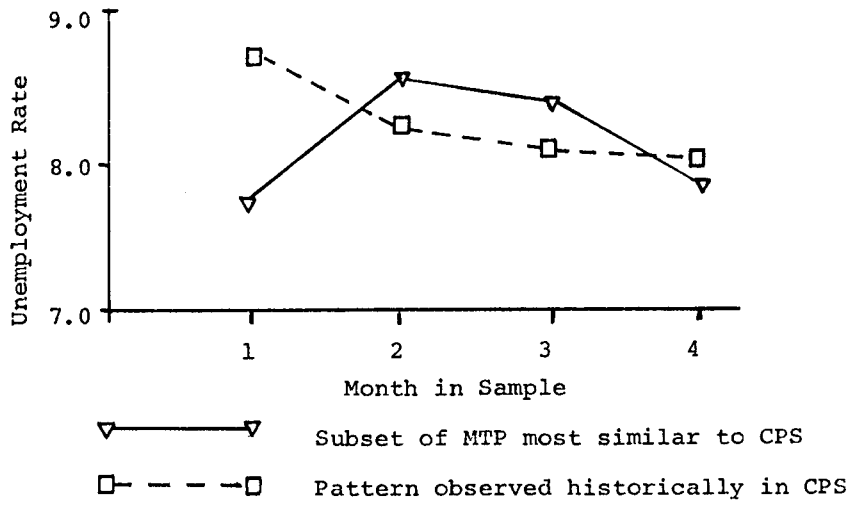


FIGURE 2: Rotation Bias in the MTP by area

