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## I. INTRODUCTION

Most statisticians working in the field of survey methodology sooner or later are faced with the task of constructing a design for a repetitive sample operation. The estimates from the survey on successive occasions are to be used to draw inferences about the underlying population and about changes in the population. If the statistician is lucky, the purpose of the survey will be clear-cut, sharply focused on a single statistic. Frequently, however, a wide variety of statistics are to be collected. These, in turn, will be subject to a variety of uses, ranging from monthly or other short run comparisons, to studies of long-term changes in patterns, or to more or less formal time series analyses. Data from a number of occasions may also be pooled to provide estimates of aggregates or annual averages, or to build up the number of sample cases in order to permit more detailed analyses of the characteristics of the population.

In addition to the usual problems of sample design, questionnaire content, and survey procedures, the statistician is now faced with an additional decision -- how much of the sample, if any, should be held constant from one period to the next and how much should be changed or rotated. For most continuing programs, the decision will be to construct some type of panel operation, that is, one in which at least part of the sample will be identical between successive periods. As will be seen later, this decision will usually be dictated by reasons of statistical reliability, budgetary efficiencies, and program advantages. Considerations of respondent cooperation and accuracy in response, however, may often rule against a fixed panel -- one in which the entire sample is identical throughout--but rather in favor of one with a systematic rotation of part of the sample.

The Census Bureau's Current Population Survey (CPS), the source of the official Government statistics on total employment and unemployment and of a wide variety of other facts about the U.S. population, is a prime example of a largescale, rotating panel type of operation involving household interviews. During the 25 years of its existence, a considerable amount of information on the operating characteristics of the CPS has been collected and analyzed. In this paper, we shall focus on those data which be believe are most relevant to reaching decisions on the sample rotation plan for a continuing program.

A brief description of the Current Population Survey may be in order at this point. The CPS is a household survey conducted with a probability sample of about 32,000 occupied units a month in 357 areas of the country. The units are selected from a combination of 1960 Census listings of addresses, area sampling methods where Census listings do not provide clear descriptions of the locations of housing units, and lists of new housing units built since the Census. The detailed sampling methods and general survey procedures used have been well documented, both in Census publications and professional journals, 1/ and will not be repeated here, except for those features relevant to the present discussion. These features are as follows:

Rotation Plan - A new sample, once selected, is subdivided into 8 systematic parts, one of which is introduced into the survey each month over an 8-month period. (Simultaneously, oneeighth of an old sample is dropped out of the sample, leaving the sample size constant.) Each such subsample, called "rotation group" is interviewed 8 different times, once a month for 4 consecutive months and then for the same 4 calendar months a year later. Under this system, 75 percent of the sample units are common from month-to-month and 50 percent from year to year. (Other degrees of overlap exist for other pairs of months, up to those 16 months apart.) The composition of the sample, in terms of age, is identical each month - that is, one-eighth of the units are being enumerated for the first time, the second eighth for the second time, etc. up until the final eighth in their last month in the sample.

Overlap of households - The previous description somewhat overstates the overlap of households or persons in the sample. The stated percentages of the sample units that are common from one period of time to another, represent

<sup>1/</sup> A concise description of this program can be found in <u>P-23 No. 13</u>, "Concepts and Methods Used in Household Statistics on Employment and Unemployment from the Current Population Survey." A much more detailed discussion is contained in <u>Technical Paper No. 7</u> "The Current Population Survey - a Report on Methodology" Bureau of the Census, U.S. Dept. of Commerce, 1963.

common addresses, not necessarily families or individuals. If a family or person moves during the period of coverage, the replacement, if any, would be interviewed. Also, nonrespondent households (of the order of 5 percent in a typical month) provide another reason for attrition from the maximum potential overlap. Thirdly, a small amount of new construction is constantly being added to the sample to insure the fact that it represents the total population at each point in time. As a consequence of these factors, the actual sample overlap of individuals is closer to 65 percent from month-to-month and 40 percent from year to year.

Data obtained in each interview - A more elaborate interview is conducted the first month a household is in the sample than in successive months. The first interview starts with a listing of all persons in the household, a series of probing questions to insure that complete coverage of persons is attained, and the collection of a group of demographic items about each person that, for all practical purposes, will not change during the period of time the household is in the sample or for which the change can be predicted. These include age, seg, color, marital status, educational attainment (for adults), and family income during the preceding year, among others. These items are asked only in the first interview, but are used in all eight months as cross-classification variables and as the basis for ratio estimates.

In each month, including the first, an identical set of labor force questions is used. Information is obtained on labor force status during the reference week, occupation and industry, number of hours worked, number of weeks unemployed for those out of work, and other related items. 2/

<u>Kinds of data tabulated</u> - Each month, tabulations are made and results are published for a standard set of statistics on current labor force status, number of hours worked and occupation of the employed, length of period of unemployment for the unemployed, and related items, many of them classified by demographic characteristics such as sex, age and color. One can consider these as one class of statistics produced. They are designed to provide a cross-section of the labor-force situation during each month, and by comparisons with prior periods to measure net changes over time.

A second class of statistics is intended to show gross flows in labor force status. These are produced by comparing the status in each of two months for all persons reporting in both months and measuring the total number of shifts that occur, together with the details of these shifts. To date such tabulations are produced only for pairs of neighboring months although it is possible to prepare similar data for pairs of months a year apart, or for that matter for any pair of months containing identical rotation groups. However, some serious problems and potential biases affect the interpretation of these data. Their publication was discontinued some years ago and they are used internally for only limited analyses. These problems will be described in a later section of this report.

A third class of statistics relate to aggregates for groups of months, such as quarterly or annual averages.

The monthly statistics (the first class described above) are produced by means of a composite estimation procedure. For each item tabulated, two separate statistics are prepared each month. One is based on the information for the current month only. The other is developed from the final estimate for the previous month to which is added a measure of change based on those parts of the sample which are common between the months. The final estimate represents a weighted average of these two estimates. 3/

#### **II. SAMPLING VARIANCES**

In any study of the sampling variances for a multi-purpose survey, the analyst is faced with as many different variances as he has separate cells in tables. In the case of CPS, this literally runs into tens of thousands. Some simplifications are obviously required to reduce these to manageable proportions. In our analyses, we have tended to focus attention on a small number of the most crucial statistics developed from the survey, and we base decisions regarding efficiency of sample design, estimation methods, etc. on their effect on these crucial statistics.

<sup>2/</sup> Supplemental questions on social or economic characteristics are frequently added on a onetime or annually recurrent basis. When introduced, they are generally asked of all households in the sample in that month. This report does not include any analysis of these statistics.

<sup>3/</sup> For information on the theory relating to sample rotation and composite estimates, see Hansen, Hurwitz and Madow "Sample Survey Methods and Theory" Vol. I pages 500-503 and Vol.II pages 272-279; Patterson "Sampling on Successive Occasions with Partial Replacement of Units", J.Roy. Stat. Soc. Series B, 12 (1950); Eckler "Rotation Sampling," Annals of Math. Stat. 26 (1955); "The Redesign of the Census Current Population Survey" by Hansen, Hurwitz, Nisselson, Steinberg, Journal of the Amer. Stat. Assoc. (Sept. 1955); Woodruff "Use of Rotating Samples in the Census Bureau's Monthly Surveys", Journal of Amer. Stat. Assoc. (June 1963).

In this paper, we will concentrate on the items which are generally of greatest concern in the monthly publications - estimates of total civilian labor force, total employment, nonagricultural employment, agricultural employment, and unemployment. For each of these, we will present data for four kinds of statistics. The first is monthly level, that is the estimate of the number of persons falling into the class (e.g. number unemployed) in a typical month. The other three kinds of statistics are month-to-month change, change from the same month a year ago, and annual averages.

Table 1 contains data on the effect of alternative approaches on the variances of the results. The CPS method is compared with a procedure in which independent samples are selected each month, and with one in which a fixed panel is used over and over again. For the CPS method, the effect of using the composite estimate is shown separately from the effect of simply retaining households in the sample. For the independent samples and fixed panels, composite estimates of this type are not applicable. The composite estimate referred to in the table has the form currently used in CPS, that is, with weights of .5 for each of the two separate estimates composing the composite.

Several other comments on table 1 will be useful: (1) First, the data represent approximations over an almost ten year period. During this length of time, the variances fluctuate somewhat, partially with fluctuations in the business cycle (for example, as the unemployment rate varies) and partially a result of seasonal changes, particularly large in the case of agricultural employment. The figures should therefore be considered as indicative of what happens in the long run, rather than as estimates of the situation at any point in time. (2) Secondly, each of the three plans listed assumes that the sampling is done within a fixed set of counties or primary sampling units (PSU's). Consequently, only the within-PSU variance is affected. For monthly level or differences between a pair of months, agricultural employment is the only one of the items for which the between-PSU variance is large enough to have any practical effect on the analysis. However, the between-PSU variance reaches one-half or more of the total variance for all items when annual averages are considered. Thus, even the independent samples do not provide as much of a reduction for an annual average as one would assume from using the equivalent of 12 monthly samples, and the loss of using correlated rather than independent samples is not as severe as would happen if the samples were completely independent. (3) Finally, the table overstates, somewhat, the virtues of a fixed panel. With either a rotating sample or independent samples, it is possible to treat more satisfactorily unexpected large units that occur in the sample and that create huge contributions to the variance. This can be done by identifying all large observations over a period of time in the past, and including them in the current time period. The

effect of this is to sample large observations at each occasion at a rate k times that of other observations, where k is the number of independent samples contributing the large observations. This is currently used in the CPS with k = 7.5. No computations have been made of the gains resulting from this device, and they are not reflected in table 1.

An examination of table 1 indicates that decisions that appear best for one of the statistics are not necessarily optimum for the others. If one were to concentrate on a single statistic, more often than not, a better rotation or estimation method could be found than the one currently used in CPS. However, when the entire array of statistics is considered, the present method appears to be a reasonable compromise in that it is at or near the optimum for all statistics except year-to-year change.

It may appear to be surprising that fixed or slowly rotating panels do not have greater advantages in measuring change over time than table 1 shows. The gains reflect two things the rotation pattern and the correlations over time for identical sample segments. For example, the ratio of the variance of month-to-month change for a fixed panel relative to independent samples, is 1-r where r is the month-to-month correlation. This ratio is extremely sensitive to high values of r. For values of r = .98 (not unusual in establishment surveys) 1-r = .02. For r = .80, 1-r = .20, or ten times as great as the previous example. Unfortunately the correlations are smaller than might be expected from identical sample units. Typical examples of correlations found in practice are shown below.

	Corre	lation for		
Item	Civilian labor force	Agricul- tural em- ployment	Unem- ploy- ment	
Pairs of neighboring months Pairs 2 months apart Pairs 3 months apart Pairs 12 months apart	.80 .70 .65 .70	.90 .85 .80 .70	.50 .40 .30 .30	

There are a number of reasons for the relatively low values of these correlations. First, people do change their labor force status from time-to-time. In particular, women and teenagers tend to move into and out of the labor force at a surprisingly high rate. Secondly, identical samples refer to identical addresses rather than persons, and this also affects the correlations. Over the course of a year, about 20 percent of the persons in the U.S. will have moved, thus reducing the correlations appreciably. Thirdly, the five percent of the designated households which are nonrespondents in a typical month have a similar depressing effect on the correlations, in that they reduce the proportion of persons identically in the sample in a pair of months. A number of modifications in the form of the composite estimate are being studied for possible further reductions in the variance. The current composite estimate can be expressed as:

$$X_{u}^{*} = (1-K) X_{u}^{*} + K (X_{u-1}^{*} + X_{u,u-1}^{*} - X_{u-1,u}^{*})$$

where X\*

composite estimate for month u

- X\* \_ composite estimate for month u-1
- X' = regular ratio estimate for month u
- X: u,u-1 = regular ratio estimate for month u using only those rotation groups that are also in the sample in month u-1
- X'u-l,u = regular ratio estimate for month u-l using only those rotation groups that are also in the sample in month u.

At present K = .5 for all items.

The first and most obvious modification being examined is to use different weights for different statistics. Another possibility is to introduce year-to-year change (as well as monthto-month change) in the estimation procedure by using an average of three different estimates, with weights of K,L, and 1-(K+L). Such an estimate can be expressed as:

$$X_{u}^{*} = \begin{bmatrix} 1 - (K+L] & X_{u}^{*} + K & (X_{u-1}^{*} + X_{u}^{*}, u-1 - X_{u-1,u}^{*}) \\ + L & (X_{u-12}^{*} + X_{u,u-12}^{*} - X_{u-12,u}^{*}) \end{bmatrix}$$

Table 2 shows approximations to the reductions in variance that would result from such modifications. It can be seen that significant improvements are possible, in particular on yearto-year change. A serious operational problem exists, however, in putting either of these plans into effect. With varying values of K (or L), inconsistencies can arise in developing the same statistic from two different tables (e.g. civilian labor force produced by itself in one table is likely to be different from the sum of employed and unemployed in another table). The differences are likely to be not large, but they will trouble the users nevertheless. We are exploring the possibility of developing some compromise solution.

Several other possible developments are also under study. These include drawing in additional months in the composite estimate, making use of the current month's data to revise estimate for the previous month, and finding better methods of adjusting for nonrespondents to dampen their effect on the correlations.

## III. COST ADVANTAGES OF PANEL OPERATIONS

One of the prime attractions of panel operations is their clear-cut cost advantage over other survey arrangements. It is rather evident that the use of the same panel on a number of occasions, as opposed to a new selection of respondents in each instance, would markedly reduce the costs of sample preparation. With the present CPS rotation pattern, a full national sample of 35,000 households is needed every eight months. The cost of selection and preparation of sampling materials for this size sample is about \$80,000 or 5 percent of the CPS budget. Clearly, it would require an overwhelming technical advantage to justify a new selection of units each month, which would multiply the sampling costs by a factor of 8, resulting in a one-third increase in the total budget.

Savings in sampling costs, however, is only one part of the increase in efficiency made possible by panel operations. There is a substantial cost incurred by interviewers in locating a set of new addresses for the first time. Once located, and assuming continuity in the interviewing staff, these same units are found much more readily in subsequent enumerations.

Aside from the matter of location, the first attempt to survey a household is likely to require more visits than a subsequent one, because the interviewer is unfamiliar with the habits of the occupants and when they are most likely to be home. According to recent CPS figures, the average number of visits to households being interviewed for the first time was 1.6, as compared with 1.3 for those in their second month of enumeration. Even the fifth enumeration, which takes place after an 8-month hiatus and is likely to see much turnover of occupants, required only 1.4 visits, on the average.

Panel operations also afford an opportunity to institute less costly collection procedures once rapport has been established with a group of respondents. In the CPS, it has been found desirable to conduct personal interviews in the first, second, and fifth months in sample to assure continued cooperation. At other times, however, telephone interviews are used wherever significant efficiencies are possible, especially where an entire cluster has telephones or to avoid return visits to households not found at home. In an average month, about 25 percent of the CPS interviews are conducted by telephones; for the rotation groups in which telephoning is permitted, the figure is about 33 percent. Even less expensive methods, such as mail inquiries, could be used effectively in many panel operations, but have not yet been found feasible in the CPS because of the precise time reference of the questions and the extremely tight timetable for conduct of the survey. 4/

<sup>4/</sup> Mail inquiries, or "leave-it" self-enumeration forms, have been used extensively, however, in special follow-up studies of subgroups of the CPS sample.

Table 3 contains a distribution of the number of visits required to complete the interviews and the number of cases interviewed by telephone for August 1964. Based on this information, and the fact that interviewer travel represents more than half of total field costs, it is estimated that the enumeration cost of a household in a new sample is probably about one-third greater than for a household in one of the five rotation groups permitting telephone interviewing. For second and fifth-month households, where the telephone is ordinarily not used but prior contacts have been made, the costs are about half way between these two levels.

A point raised earlier--that of recording at the time of first-enumeration many basic demographic facts about the residents of each CPS sample unit--represents still another efficiency of panel operations. Once obtained, these data are automatically available in subsequent periods for cross-classification or other purposes, although some updating is necessary from time-to-time. The preparation of the basic original record takes about 10 minutes per household, on the average, whereas such updating as is needed usually averages only a fraction of a minute. This alone adds 10 to 20 percent to the enumeration cost.

When these individual components of cost are put together, it can be estimated that if a survey of the size and characteristics of the CPS were conducted with an independent sample each month, the cost would be at least 75 percent greater than with the present rotation system, and possibly as much as twice as great. Conversely, of course, a fixed panel would save money, but because of the slow rotation system used in CPS, the difference would be much more modest--possibly of the order of 10 percent.

#### IV. INCREASED ANALYTICAL OPPORTUNITIES

It would be remiss to omit at least a brief reference to the analytical opportunities offered by panel operations. Already mentioned are the so-called gross flow or gross change data, which provide a cross-classification of the status of an identical group of individuals from one month to the next (or over other periods). In the case of CPS, for example, data are tabulated on the number entering or leaving the labor force from month-to-month, the number shifting in either direction between an employed and an unemployed status, and numerous related flows, thus revealing the dynamics of the labor market which are often concealed in the over-all net changes.

In a broader sense, the use of panels over longer periods provides the framework for the true "longitudinal" study with a much wider range of possibilities. Since a given CPS panel extends over only a 16-month period with interviews conducted in only 8 of the 16, there are obvious limits in this respect. Aside from the gross changes, however, there are opportunities within this cycle for assembling in the same record information collected on different regular or supplementary subjects in different months for the same individuals. This is a means of expanding the detail known about a given group of households without subjecting them to an unduly long interview at any one time.

#### V. EFFECT ON RESPONSE

With the massive evidence assembled in favor of panel operations, one might conclude that only the uninitiated or the foolhardy could ever consider anything else in establishing a continuing statistical program. In fact, one might ask why CPS does not move even further in this direction and use a fixed panel. Unfortunately, in most human endeavors, benefits are seldom bestowed without exacting a certain price. In this case, the price is the possibility that the information provided by households will be affected or influenced in some way by the fact that they are interviewed on repeated occasions -- in more technical terms, that there will be some conditioning of response in the panel.

An obvious example which comes to mind was a one-time proposal to establish a representative panel of individuals who would receive medical examinations at regular intervals, thus providing a measure of the changing health of the population, the effect of aging, and selected facts. A rather awkward problem was envisioned however, arising from the fact that the participants would learn they had previously undetected health problems. (It would presumably be unethical to conceal serious conditions from them.) This knowledge would undoubtedly impel them to seek medical treatment, and while the next survey might show an impressive improvement in the health of the panel, this could scarcely be projected to the general population.

The information collected in the CPS is hardly likely to have as dramatic an impact on the individuals concerned, but strong evidence of conditioning in response nevertheless exists. In particular, a phenomenon has been observed which has loosely been termed the "first-month" bias, since its effect has been most pronounced when comparisons are made between households being interviewed for the first time, and those who had been interviewed in past months. 5/Illustrations of the effects of the first-month bias are presented in table 4. It can be seen that households in the first month of enumeration show significantly higher levels of unemployment and of part-time and marginal employment than is found for households interviewed for the second or later time. In most cases, the differences are attributable to women, teenagers, and others whose participation in

<sup>5/</sup> This term has been used for convenience and does not necessarily imply that the first month's data are biased in a statistical sense.

the labor force is often on an intermittent basis. 6/ A somewhat less striking, but rather persistent, downtrend has also been observed in population coverage as the sample ages.

Although there are many theories, the reasons for these sharp differentials have never been satisfactorily established. One hypothesis is that interviewers are more careful in conducting the first enumeration since they have no advance information about the households. Subsequently, they may assume that some persons, such as housewives and teenagers, who were outside the labor force the first time continued in that status without asking the questions completely, and without realizing that these are the persons who account for most of the shifts into and out of the work force. A contrary opinion is that new respondents may over-report employment or unemployment because they are initially uncertain of the purpose of the survey or wish to appear more usefully occupied.

Knowledge of this problem has existed for many years without being a major concern of analysts of labor force data because the extent of the bias did not seem to be a serious limitation on uses of the data. In particular, the effect on over-all changes from month-to-month or over other periods was known to be quite small since the sample at any time consisted of the same mixture of households in different stages of enumeration. Demands in recent years for greater precision in the standard data and for a revival of publication of the gross change data have, however, stimulated a growing concern for finding solutions to the problem. Gross change data are especially subject to downward biases resulting from conditioning since, by definition, they involve a comparison of data for earlier with later periods of enumeration of the same individuals. 7/

As a consequence of these emerging needs, a good deal of research has been initiated on response problems in general and conditioning effects in particular. In an experimental study operated in three areas and involving some 1,500 interviews a month, the Bureau has been testing

7/ Gross change data also suffer from biases resulting from the exclusion of sample cases which are not identical between the periods being compared, such as migrants, nonrespondents, and the like. For a more detailed discussion of gross change data, see paper by Robert B. Pearl, "Gross Changes in the Labor Force: A Problem in Statistical Measurement," <u>Employment and Earnings</u> (U.S. Bureau of Labor Statistics) Vol. 9, No. 10, April 1963. during the past year and a half several alternative approaches to collection of labor force data. Among the alternatives examined have been a far more detailed questionnaire than the present one, and a procedure in which self-enumeration is attempted after the first month, with telephone and personal follow-up of nonrespondents. A third alternative is a procedure whereby an independent interview is taken but the interviewer also has access to a summary of the information for the previous month and attempts to obtain an explanation and confirmation of any basic changes in employment status and job attachment. The standard CFS questionnaire and procedure is used as a control in the experiment.

Table 5 summarizes data from the experimental study relevant to whether any of the procedures appeared to modify the usual effect of conditioning. Sampling errors are too large to reach any definite conclusions, but our judgment is that only procedure D (which provided for a comparison by the interviewer with the previous month's data) showed any evidence along these lines. Work still must be done to ascertain whether this results in improved data, since availability of prior month's information could create a false stability or a concealed form of conditioning.

During the past six months, another experiment has been going on, investigating the possibility that the first month bias results from interviewers becoming overly familiar with the households in their assignments. This test, which has been taking place in a subset of areas included in the regular CPS sample, provides for changes in interviewer assignments between the first and second, and the seventh and eighth months of enumeration of the same households. These are the stages between which the largest differentials in response generally appear. Table 6 summarizes the findings to date. These data are preliminary since the experiment is not yet over. The results are too fragmentary as yet to render final judgments although, it must be conceded, they do not appear especially encouraging in providing an answer to this problem.

We hope that the present efforts will provide some insights into this perplexing phenomenon, which casts a shadow on various types of panel operations and frustrates the introduction of more sophisticated techniques in estimation procedures, at least for household surveys such as the CPS where the interviewer or respondent's motivation and attitude towards the interview, may influence the results. Clearly, a wider dissemination of the experience of various public and private survey groups which conduct panel operations should enhance the chances of a breakthrough in this area.

<sup>6/</sup> A more detailed presentation of these data appears in a paper prepared by the present authors, entitled "The Effects of Repeated Household Interviews in the Current Population Survey," for the National Conference of the American Marketing Association, Dallas, Texas, June 17, 1964.

#### Table 1.--COMPARISON OF VARIANCES IN CURRENT POPULATION SURVEY FOR ALTERNATE TYPES OF ROTATION PLANS, FOR SELECTED LABOR FORCE ITEMS

(Figures shown represent the ratios of the variances of each rotation plan to a system in which independent samples are used each month. The data assume identical sample sizes and a similar estimation procedure for all plans--the ratio estimation used for the CPS--except the lines for "with composite estimate" which superimpose the composite estimate as used in CPS on the ratio estimates. The data refer to an "average" month, or pair of months.)

Item	Civilian labor force, total and nonagricultural employment	Agricultural employment	Unemployed
Monthly level			
Independent samples Fixed panel CPS rotation system Without composite estimate With composite estimate	1.00 1.00 1.00	1.00 1.00	1.00 1.00
Month-to-month_change		.,.	1.0)
Independent samples Fixed panel CPS rotation system Without composite estimate With composite estimate	1.00 .20 .40 .28	1.00 .10 .31 .18	1.00 .55 .65 .60
Change from year ago			
Independent samples Fixed panel CPS rotation system Without composite estimate With composite estimate	1.00 .30 .65 .57	1.00 .30 .65 .55	1.00 .70 .85 .90
Annual average			
Independent samples Fixed panel CPS rotation system Without composite estimate With composite estimate	1.00 3.00 1.50 1.60	1.00 1.70 1.20 1.25	1.00 2.00 1.40 1.50

# Table 2.--OPTIMUM VALUES OF WEIGHTS IN ALTERNATE COMPOSITE ESTIMATES, AND RESULTING REDUCTIONS IN VARIANCES FROM CURRENT COMPOSITE ESTIMATE USED FOR CPS, FOR SELECTED LABOR FORCE ITEMS

Item	Optimu current	m weights with estimation method	Optimum year-to-	weights using -year change		
	к	Ratio of variance to variance of current estimate	K, L	Ratio of variance to variance of current estimate		
Monthly level						
Civilian labor force total and nonagricultural employment	.6	.98	.5, .2	.86		
Agricultural employment	.7	.89	.7, .1	.81		
Unemployment	•3	.96	.2, .2	.90		
Month-to-Month change						
Civilian labor force total and nonagricultural employment	.8	.92	.7, .1	•90		
Agricultural employment	.9	.73	.8, .1	•73		
Unemployment	•5	1.00	.4, .1	•99		
Change from year ago						
Civilian labor force total and nonagricultural employment	.5	1.00	.4, .3	.74		
Agricultural employment	.7	.89	.6, .2	.74		
Unemployment	.2	.91	.2, .3	.80		

Number of		Type of inte	erview	For personal visit households, number of visits required to complete the interview							
sample	sample Total Telephone Visit		Total	l	2	3+	Average number of visits				
1	100.0	0.1	99.9	100.0	61.8	22.5	15.7	1.57			
2	100.0	4.2	95.7	100.0	76.9	16.3	6.8	1.31			
3	100.0	30.4	59.6	100.0	77.4	15.7	6.9	1.31			
4	100.0	34.7	55.3	100.0	78.1	16.0	5.9	1.29			
5	100.0	0.9	99.1	100.0	69.1	20.2	10.7	1.44			
6	100.0	29.1	60.9	100.0	78.4	14.9	6.7	1.30			
7	100.0	33.3	66.7	100.0	78.8	13.5	7.7	1.30			
8	100.0	20.2	79.8	100.0	71.7	19.2	9.1	1.39			

# Table 3.--PERCENTAGE DISTRIBUTION OF INTERVIEWED HOUSEHOLDS BY METHOD OF INTERVIEW, AND FOR THOSE INTERVIEWED BY PERSONAL VISIT BY NUMBER OF VISITS, AUGUST 1964 CPS

NOTE: The second and eighth-month households were involved in an experimental study during August which could have affected the average number of visits and the use of telephone enumeration. These two groups should therefore be omitted from any analysis of the difference between new households and those that have been interviewed in earlier months.

Table	4SUMMARY	OF	CPS	EMPLOYM	ENT	STAT	US	MEASU	RES,	BY	ROTATION	GROUP:	
		AVE	RAGI	E, MARCH	195	9 -	DEC	EMBER	1961	L			

(	Index	numbers:	A11	groups	combined	_	100	) 1	1
١.	TIMCY	mamoero.	<b>UTT</b>	Broupp	comprised	-		/ -	/

			Nu	mber of mon	ths in sam	ple:		
Measure	lst month	2nd month	3rd month	4th month	5th month	6th month	7th month	8th month
Civilian labor force	101.1	100.4	100.5	99.9	99.7	99.5	99.6	99.4
Total employed	100.7	100.4	100.4	100.0	99.6	99.4	99.7	99.6
Employed in nonagricul- tural industries	100.8	100.4	100.3	100.0	99.6	99.5	99.6	99.5
Employed in agriculture	99.6	99•7	100.9	100.5	99.4	98.5	100.6	101.0
Unemployed	107.3	100.3	100.3	98.9	100.7	99.6	96.6	95.0
Private household workers 2/	106.4	100.5	97.4	98.8	101.1	98.7	98.0	98.8
Nonagricultural self-employed	102.0	100.4	99.9	98.8	101.0	99.9	99.4	98.4
Nonagricultural unpaid family workers	102.7	106.6	102.8	99.2	102.7	101.9	99.6	95•3
Regular part-time workers <u>3</u> /	103.7	100.0	98.6	98.1				

1/ Absolute numbers first converted into percentages of population in rotation group and then into index numbers. The ratio estimates to independent estimates of the population by age-sex-color are applied separately by pairs of rotation groups--the lst and 5th combined, the 2nd and 6th, etc. Consequently, items comprising high proportions of the population generally average out to close to 100 percent by these pairs of rotation groups.

2/ Domestic servants, babysitters, odd-job workers, and the like.

3/ Persons who usually work part time for noneconomic reasons. Information only available by rotation set (1st and 5th months combined, 2nd and 6th months combined, etc.).

#### Table 5.--COMPARISON OF LABOR FORCE AND UNEMPLOYMENT RATES, BY NUMBER OF MONTHS IN SAMPLE, FOR ALTERNATIVE PROCEDURES USED IN CPS METHODS TEST (3-AREA EXPERIMENTAL PROGRAM): JULY 1963 - JUNE 1964

(Index numbers: average of 4 rotation groups = 100)

(lal	Index of por force a 14 ye	labor for as percent ears and c	ce rates of popul over)	Index of unemployment rates (unemployed as percent of civilian labor force)					
All rot <b>a-</b> tion groups	lst month in sample	2nd month in sample	3rd month in sample	4th month in sample	All rota- tion groups	lst month in sample	2nd month in sample	3rd month in sample	4th month in sample
100.0	101.6	98.9	100.2	99.1	100.0	109.6	101.5	98 <b>.</b> 7	90.2
100.0	102.5	99.8	98.9	98.6	100.0	110.4	103.3	101.8	84.1
100.0	101.6	98.8	100.2	99.5	100.0	116.0	116.1	84.2	83 <b>.</b> 7
100.0	100.5	<b>99.</b> 6	99.5	100.5	100.0	99.0	93.4	98.6	109.3
	(1a) All rota- tion groups 100.0 100.0 100.0	Index of (labor force a 14 yr   All rota- tion groups lst month in sample   100.0 101.6   100.0 102.5   100.0 101.6   100.0 101.5	Index of labor for (labor force as percent 14 years and cAll rota- tion groupslst month in sample2nd month in sample100.0101.698.9100.0102.599.8100.0101.698.8100.0101.698.8100.0101.698.8	Index of labor force rates (labor force as percent of popul 14 years and over)All rota- month tion groupslst month in sample2nd month month in sample3rd month in sample100.0101.698.9100.2100.0102.599.898.9100.0101.698.8100.2100.0101.698.8100.2100.0101.698.8100.2	Index of labor force rates (labor force as percent of population 14 years and over)All rota- month tion groupslst month in sample2nd month month in sample3rd month month in sample4th month in sample100.0101.698.9100.299.1100.0102.599.898.998.6100.0101.698.8100.299.5100.0101.698.8100.299.5	Index of labor force rates (labor force as percent of population 14 years and over)All rota- month in groupslst month in sample2nd month month in sample3rd month month in sample4th rota- 	Index of labor force rates (labor force as percent of population 14 years and over)Index of (unemploidential civil:All rota- tion groups1st month in sample3rd month in sample4th month in sampleAll rota- month in sample1st month in sample100.0101.698.9100.299.1100.0109.6100.0102.599.898.998.6100.0110.4100.0101.698.8100.299.5100.0116.0100.0101.698.8100.299.5100.0116.0	Index of labor force ratesIndex of unemployed as percent of population 14 years and over)All rota- month in groups1st month in in sample2nd month month in sample3rd month month in sample4th month month in sampleAll rota- month in sample1st month month in sample2nd month month in sample100.0101.698.9100.299.1100.0109.6101.5100.0102.599.898.998.6100.0110.4103.3100.0101.698.8100.299.5100.0116.0116.1100.0100.599.699.5100.5100.099.093.4	Index of labor force rates (labor force as percent of population 14 years and over)Index of unemployment rates (unemployed as percent of civilian labor force)All rota- tion groups1st month in sample2nd month in sample3rd month in sample411 month rota- tion sample1st month in sample2nd month in sample3rd month month in sample411 month rota- tion groups1st month month in sample2nd month month in sample3rd month month in sample100.0101.698.9100.299.1100.0109.6101.598.7100.0102.599.898.998.6100.0110.4103.3101.8100.0101.698.8100.299.5100.0116.0116.184.2100.0100.599.699.5100.5100.099.093.498.6

1/ The self-enumeration procedure started in the second month; the standard CPS questionnaire was used in personal interview the first month.

2/ Starting in the second month, this procedure involved first an independent interview and then a comparison with the results from the previous month and a check and confirmation of basic changes in status. In the first month, only a direct interview was taken since there was, of course, no comparative data for prior periods. In about half of the cases, the standard CPS questionnaire was used in this procedure and in the remaining half, the detailed questionnaire (used in procedure B) was specified.

# Table 6.--EFFECT ON LABOR FORCE STATUS OF CHANGING INTERVIEWER ASSIGNMENTS FOR SECOND AND EIGHTH-MONTH ROTATION GROUPS, FOR SELECTED PSU'S IN CPS

(Data are in the form of index numbers. Each index represents the ratio of the number reported in that rotation group to the average of all rotation groups. For each characteristic, the first line of data is an average for the period July 1963 - June 1964, before the changes in assignment were instituted, the second line covers the period July - November 1964, when changes were made. Both lines refer to an identical set of PSU's, which include about one-third of the total CPS sample.)

		Number of months in sample									
Item	Procedure	1	2	3	4	5	6	7	8		
Total males,	Regular CPS	1.009	0.996	1.006	0.997	0.996	0.999	0.997	1.000		
14 years and over	Interviewer change	0.982	0.996	0.991	1.000	1.024	1.016	1.010	0.980		
Male, civilian	Regular CPS	1.020	1.000	1.007	0.999	0.993	0.993	0.995	0.994		
labor force	Interviewer change	0.991	0.996	0.986	0.998	1.026	1.014	1.000	0.989		
Male, employed in nonag. industries	Regular CPS	1.013	0.995	1.005	0.996	0.996	1.000	0.999	0.996		
	Interviewer change	0.986	0.994	0.985	0.995	1.017	1.016	1.002	1.005		
Male,	Regular CPS	1.113	1.070	1.042	1.050	0.976	0.900	0.932	0.917		
unemployed	Interviewer change	1.056	1.015	0.953	1.071	1.010	0.985	0.971	0.940		
Total females,	Regular CPS	1.008	1.004	1.015	1.008	0.997	0.999	0.986	0.984		
14 years and over	Interviewer change	0.994	0.997	0.987	0.999	1.012	1.008	1.014	0.989		
Female, civilian	Regular CPS	1.050	1.015	1.008	0.998	1.008	0.975	0.977	0.968		
labor force	Interviewer change	1.027	1.003	0.974	0.984	1.015	1.006	0.997	0.995		
Female, employed in nonag. industries	Regular CPS	1.037	1.011	1.011	0.999	1.008	0.980	0.980	0.973		
	Interviewer change	1.010	1.003	0.976	0.984	1.009	1.014	1.002	1.001		
Female,	Regular CPS	1.224	1.062	0.970	0.970	1.003	0.922	0.955	0.895		
unemployed	Interviewer change	1.222	1.017	0.917	0.978	1.116	0.871	0.966	0.914		