Volume Title: Labor Statistics Measurement Issues

Volume Author/Editor: John Haltiwanger, Marilyn E. Manser and Robert Topel, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-31458-8

Volume URL: http://www.nber.org/books/halt98-1

Publication Date: January 1998

Chapter Title: The CPS after the Redesign: Refocusing the Economic Lens

Chapter Author: Anne E. Polivka, Stephen M. Miller

Chapter URL: http://www.nber.org/chapters/c8362

Chapter pages in book: (p. 249 - 289)

7 The CPS after the Redesign: Refocusing the Economic Lens

Anne E. Polivka and Stephen M. Miller

The Current Population Survey (CPS) is a major source of information about the American labor market. In addition to providing monthly estimates of unemployment and employment, economists, sociologists, and policy analysts use data from the CPS to examine broad societal and cyclical changes in economic activity over time. For example, data from the CPS have been used to investigate the declining rate of employment among men, especially older men (e.g., Peracchi and Welch 1994), the rising labor force participation rate of women since the 1960s (Smith and Ward 1985; Michael 1985), the changing demographic composition and number of the self-employed (Devine 1994a, 1994b; Aronson 1991), the fluctuations in the number of involuntary part-time workers over the business cycle (Blank 1990), the increase in wage inequality over time (Levy and Murnane 1992; Bound and Johnson 1992), and the relationship between unemployment and inflation (Tobin 1972; Murphy and Topel 1987).

In January 1994, the CPS underwent a major redesign both in the wording of the questionnaire and the methodology used to collect the data. The objective of the redesign was to improve the quality and expand the quantity of available data. However, the redesign also caused changes in the measurement of many of the estimates derived from the CPS. The major purpose of this paper is to estimate adjustment factors for various aggregate measures derived from the CPS in order to permit comparisons of estimates before and after the redesign. In addition, these adjustment factors will be analyzed to assess

Anne E. Polivka is a research economist in the Office of Employment Research and Program Development at the Bureau of Labor Statistics, U.S. Department of Labor. Stephen M. Miller is a mathematical statistician in the Office of Survey Methods Research at the Bureau of Labor Statistics, U.S. Department of Labor.

The views in this paper are those of the authors, and do not represent official Bureau of Labor Statistics policy.

the impact of the redesign on some of the key conclusions drawn from the CPS.[1]

The remainder of the paper is structured as follows. Section 7.1 briefly summarizes the reasons for the CPS redesign. Section 7.2 contains a description of the data and a discussion of the motivation for the methodology used in the empirical analysis. Section 7.3 presents the empirical model. The estimated adjustment factors, along with a discussion of possible causes and implications of the estimated changes, are presented in section 7.4. The paper concludes with a brief summary of the results and implications of the redesign.

7.1 Reasons for Redesigning the Current Population Survey

The redesigned CPS was the culmination of a massive eight-year collaborative effort between the Bureau of Labor Statistics (BLS) and the Bureau of the Census. The impetus for changing the CPS was fourfold. First, there were indications that some of the concepts and wording in the CPS were becoming dated. The last major revision to the wording of the CPS occurred in 1967. Since that time there have been many changes in the U.S. labor market. Women's labor force activity has increased dramatically. Service sector employment has grown. The proportion of the employed working in factory jobs has declined. Two-income households have become the norm in husband-wife households. Single-parent households have become more prevalent. The population has grown older, and minorities constitute a larger proportion of the labor force than previously. Given these societal changes, some of the wording of the CPS questions were inappropriate, and new situations had arisen that were not adequately covered by the survey.

For example, in the unrevised CPS, interviewers were instructed to tailor the wording of the first labor force question to the gender and age of the respondent. Specifically, if the respondent "appears to be a homemaker," the manual instructed interviewers to ask, "What were you doing most of last week—keeping house or something else?" If the respondent appeared to be relatively young, interviewers were supposed to ask, "What were you doing most of last week—going to school or something else?" For all other respondents, interviewers were instructed to ask, "What were you doing most of last week—working or something else?" The next question about work activities in the unrevised questionnaire included the phrase "not counting work around the house." Given the increased labor market activity of women and the rising prevalence of home offices or other work arrangements that involve individuals working from their homes, the wording of these questions could be both offensive and confusing (Polivka and Rothgeb 1993; Rothgeb 1994; Polivka 1994).

Other examples of the datedness of the CPS occurred with respect to the

1. The estimates presented in this paper are being provided only to aid individuals who use the CPS historically. The Bureau of Labor Statistics will not revise previously published official estimates.

recording of reasons why individuals were working part time or were absent from work. The unrevised CPS did not include the response categories of child care problems or maternity or paternity leave. In the mid-1960s, when the last redesign was implemented, dual-income households and women working outside of the home were not as prevalent. However, with the tremendous increase over the past quarter-century of women in the labor market, the lack of these response categories raised the probability of answers being inaccurately classified and reduced the usefulness of the data (Fracasso 1989).

Investigation also revealed that the meaning of several phrases and words in the CPS have changed over time. An important example of shifting meanings involves the measurement of individuals "on layoff." In the past, most people defined a layoff as a temporary spell of unemployment from which an individual expected to be recalled as soon as business conditions improved or retooling was completed. Research showed, however, that in the late 1980s and early 1990s, the majority of individuals used the word "layoff" to refer to permanent separations from which they did not expect to be recalled (Rothgeb 1982; Palmisano 1989).

A second motivation for the revisions is that changes previously recommended in the 1970s—most notably those from the National Commission on Employment and Unemployment Statistics—had not been fully implemented. Several recommendations were tested in the 1980s through the Methods Development Survey jointly developed by the BLS and the Bureau of the Census, but lack of funding for a large overlap sample to assess the effect of the changes precluded the implementation of these recommendations.

The changes that were occurring in survey methodology provided a third impetus for redesigning the CPS. In the early 1980s, the introduction of cognitive psychological theory and research methods provided a means for understanding and reducing measurement error in the survey process (Jabine et al. 1984). Two important aspects of the application of cognitive methodology were used in the redesign of the CPS. One was the development of a psychological model to relate psychological theory to how the questionnaire affects responses, and the other was the incorporation of laboratory techniques into the questionnaire design and testing process (Dippo et al. 1994).

A fourth reason for the revision was the advent of the ability to conduct surveys using laptop computers. The use of laptop computers made it possible to develop a completely computerized survey instrument. In turn, a computerized instrument permitted the methods and procedures used to conduct interviews to be altered. For example, use of a computer allows information from a previous interview to easily be inserted into the current interview and permits internal data consistency checks to be built into the survey.[2]

For these reasons, an effort to redesign the CPS was begun in 1986. From

2. For a more complete description of the general motivation for the CPS revision, see Bregger and Dippo (1993). For a discussion of the motivation of specific questionnaire changes, see Polivka and Rothgeb (1993). For a description of the use of computers in redesigning and administering the CPS, see Dippo et al. (1994).

1988 through 1991, a series of research projects was conducted to guide the development of the revised CPS. Included in this research were two large-scale tests of alternative versions of the questionnaire collected using centralized computer-assisted telephone interviewing with samples of households selected through random digit dialing. The result of these tests was a completely revised questionnaire designed to be collected with an entirely automated survey instrument.

7.2 The Data

As mentioned in the introduction, the major goal of this paper is to provide a set of adjustment factors that account for the redesign for application to aggregate estimates derived from the CPS. Initially, to assess the effect of the redesign, a parallel survey was conducted using the new automated collection procedure from July 1992 through December 1993. This parallel survey provided the BLS with its first estimates of the expected effect of the redesign. For example, based on the parallel survey it was estimated that the redesign would increase the overall unemployment rate 0.5 percentage points and that the increase would be larger for women than for men. The initial parallel survey estimates also indicated that the employment-to-population ratio would be 0.7 percentage points higher for women and 0.6 percentage points lower for men after implementation of the redesign.[3]

As an additional tool to assess the impact of the redesign, households in the sample used for the parallel survey were interviewed with the unrevised procedures from January 1994 through May 1994. The primary purpose of extending the parallel survey, while switching households to the old procedures, was to obtain an estimate of what the unemployment rate would have been under the old procedures. However, examination of the data from the extended parallel survey called into question the interpretation of some of the results of the initial parallel survey. Specifically, the unemployment rate, rather than being lower than in the CPS when the parallel survey was conducted with the old methodology, instead remained higher. As can be seen in figure 7.1, plots of parallel survey and CPS estimates of monthly unemployment rates do not cross as would be expected if the new methodology were increasing the rate.

The failure of the two plots to cross suggests that there may have been something specific to or distinct about the parallel survey. In other words, there may have been a "parallel survey effect." This parallel survey effect could exist even for estimates that appeared to perform as predicted by the initial parallel survey. For example, figure 7.2 indicates that monthly estimated employment-to-population ratios for women were, by and large, higher in the parallel survey

3. More detailed estimates of the effect of the redesign from the initial parallel survey can be found in Cohany, Polivka, and Rothgeb (1994).

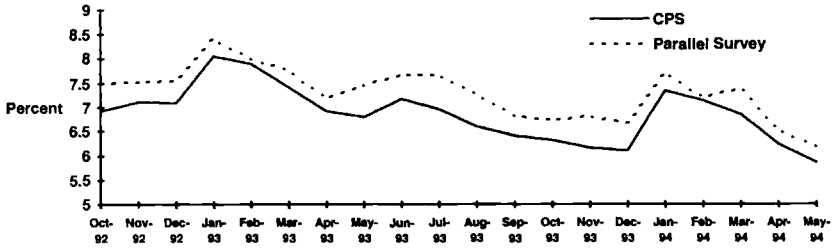

Fig. 7.1 Total national unemployment rates (not seasonally adjusted)

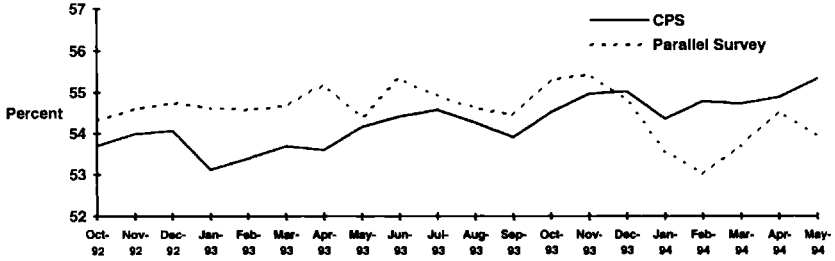

Fig. 7.2 Employment-to-population ratios for women (not seasonally adjusted)

than in the CPS prior to January 1994 and were lower in the parallel survey than in the CPS after January 1994. This crossing of the plots is consistent with there being a new method effect on women's estimated employment-to-population ratio. However, if there is a parallel survey effect in addition to a new method effect, the effect of the redesign on women's employment-to-population ratios would be different from what was observed prior to January 1994, since prior to January 1994 the two effects would be confounded.

A parallel survey effect could occur for a variety of reasons. For example, a parallel survey effect could be due to differences between the CPS sample and the sample used for the parallel surveys, differences in supervision of the interviewer staff between the CPS and the parallel surveys, or differences that arose just because respondents and interviewers knew that they were part of an experiment. The last effect is sometimes referred to as a "Hawthorne effect."

Given the graphical results and the possibility of a parallel survey effect, it is important to construct adjustment factors that control for a parallel survey effect. Consequently, data collected with the parallel surveys using the new procedures prior to January 1994 and the unrevised procedures from January through May 1994, along with data collected from the unrevised CPS prior to January 1994 and the revised CPS beginning in January 1994, will all be used in the estimation of adjustment factors. Throughout the remainder of this paper, estimates and data pertaining to the portion of the parallel survey test conducted prior to January 1994 will be referred to as "parallel survey prior to

January" estimates or data (PSpj). Estimates or data pertaining to the portion of the parallel survey conducted since January 1994, using the unrevised procedures, will be referred to as "parallel survey since January" estimates or data (PSsj). Estimates or data derived from the unrevised CPS will be referred to as "unrevised CPS," "old method," or "unrevised methodology" estimates or data. Estimates or data derived from the revised CPS after January 1994 will be referred to as "revised CPS" or "revised methodology" estimates or data.

To aid in subsequent discussion of the statistical modeling and to provide additional insight into why a parallel survey effect may exist, the sample design and procedures used in each of the surveys are described below.

7.2.1 Unrevised Current Population Survey (Old Method before January 1994)

The CPS includes 60,000 households monthly that are selected to represent the population in the nation and each state. The probability sample of housing units is drawn using a multistage stratification procedure. The largest metropolitan areas within each state are always included; the remaining areas of a state are sampled on a probability basis, with the probability of selection being proportionate to the population of the area. In an effort to balance respondent burden with improved estimates of change, households are interviewed for four consecutive months, not interviewed for the next eight consecutive months, and then interviewed for another four consecutive months. Each month, a new household panel of approximately one-eighth of the total monthly sample size is initiated, and the panel that received its eighth interview the previous month is dropped. Given this rotating panel structure, in any month one-eighth of the households will be receiving their first interviews, one-eighth will be receiving their second interviews, one-eighth will be receiving their third interviews, and so forth. This rotating panel structure means that three-quarters of the sample in a given month is retained in the sample the next month. This improves estimates of month-to-month change, but it also means that there is a great deal of correlation in the data month to month. The first interview in each of the four consecutive interview months is conducted through a personal visit. In subsequent months, the majority of interviews are conducted over the phone, either from interviewers' homes or from one of two centralized computer-assisted telephone interviewing (CATI) facilities. The majority of the unrevised CPS data were collected with a paper survey instrument, although approximately 9 percent of the data were collected by interviewers working in the two centralized CATI facilities.

7.2.2 Revised Current Population Survey (New Method since January 1994)

Starting in January 1994, the 60,000-household CPS sample was switched to the revised questionnaire and computerized collection procedure. The rotation pattern established prior to January 1994 was maintained; therefore, 88 percent

of the households that received the revised CPS questionnaire and procedures in January 1994 had previously received the CPS using the unrevised questionnaire and procedures, with 75 percent of the households having experienced the unrevised CPS in December 1993. Except for staff turnover, all of the CPS interviewers in January 1994 had previous experience with the unrevised CPS. The revised CPS data were collected entirely with the new computerized instrument. Again, the majority of the households were interviewed in a decentralized manner, either through personal visits or by telephone from interviewers' homes. In January 1994, a little less than 13 percent of the data were collected from the centralized CATI facilities. By May 1994, the percentage of interviews conducted by CATI in the revised CPS had increased to 14.5 percent.

7.2.3 Parallel Survey prior to January (New Method before January 1994)

The parallel survey prior to January 1994 (PSpj) included 12,000 households that were interviewed monthly starting in July 1992. The sample design for the PSpj was that used by the National Crime Victimization Survey, which is conducted by the Bureau of the Census for the Bureau of Justice Statistics. Like the CPS, the PSpj sample was drawn using a multistage stratified design. Unlike the CPS's state-based design, geographic areas for the PSpj were selected only to be nationally representative. The PSpj had the same 4-8-4 interview rotation pattern as the CPS. However, since the PSpj was initiated in 1992 and it takes 16 months to phase in this type of rotation scheme, September 1993 was the first month in which the rotation scheme was fully in place.[4] As in the CPS, the first and fifth month-in-sample households in the PSpj were interviewed through personal visits. In subsequent months, the majority of interviews were conducted by telephone. In the PSpj, 82 percent of the data were collected by field representatives using laptop computers, either during personal visits or by telephone from their own homes. The remaining 18 percent of the data were collected using CATI by a separate staff of interviewers working in the same two centralized facilities used for the CPS. The interviewer

4. The rotation scheme was such that from October 1992 forward all of the households in month-in-sample 1 through 4 actually were interviewed for their first through fourth times. In October 1992, the month-in-sample 1 through 4 households constituted 50 percent of the sample. At the same time, half of the survey households were designated as month-in-sample 5 through 8. The majority of these households actually were having their first through fourth monthly interviews, where households designated as month-in-sample 5 were really month-in-sample 1, households designated as month-in-sample 6 were really month-in-sample 2, etc. Historically, changes in estimates for month-in-sample 5 through 8 have shown the same pattern as changes in estimates for month-in-sample 1 through 4. A small percentage of the month-in-sample 5 households in October 1992 had been previously interviewed in January 1992 as part of a large-scale operations test of the new instrument and collection procedures. Starting in January 1993, 30 percent of the households designated as month-in-sample 5 actually were being interviewed for the fifth time after having not been interviewed for eight months. The percentage of "true" month-in-sample 5 households increased to 63 percent in April 1993 and 100 percent in May 1993. The percentage of true month-in-sample 6 through 8 households followed a similar pattern to the month-in-sample 5 households lagged by one calendar month.

staff for the PSpj was drawn to reflect the experience of CPS interviewers in a given year. Fifty percent had experience on the unrevised CPS, 25 percent had experience on other Census Bureau surveys, and 25 percent were new hires. While the PSpj was being conducted, none of the PSpj interviewers conducted the unrevised CPS. The PSpj had a supervisory staff that was separate and independent from that for the unrevised CPS. For each supplement conducted in the CPS from July 1992 through December 1993, a computerized version was also administered in the PSpj. Due to factors related to the initialization of the new procedures and implementation of the revised questionnaire, only data from October 1992 to December 1993 will be used for analysis.

7.2.4 Parallel Survey since January (Old Method since January 1994)

Starting in January 1994, the sample used for the PSpj was switched to the unrevised CPS paper questionnaire. Given the rotation structure of the parallel survey sample, this meant that in January 1994, 88 percent of the respondents had previous experience with the revised computerized questionnaire and, for 75 percent of the sample, this experience had been in December 1993. By May 1994, the percentage of respondents who had previous experience with the revised CPS had decreased to 50 percent, with none of this experience having occurred in a contiguous month. In January 1994, approximately 16 percent of the households in the parallel survey since January (PSsj) were eligible to be interviewed through CATI. By May 1994, the percentage of interviews eligible to be conducted by CATI had been reduced to 9 percent. Twenty-six percent of the field interviewers for the PSsj had conducted interviews with the unrevised CPS using the paper instrument. The majority of the remaining field interviewers were newly hired to work on the PSsj. Approximately 6 percent of these new hires had received training on the new questionnaire and methodology. None of the CATI interviewers for the PSsj had experience with the old questionnaire. The PSsj had the same supervisory staff as did the PSpj. The PSsj did not have any of the supplements that were administered with the revised CPS in 1994. It is important to note that the switching of the same households from the PSpj to the PSsj permitted an estimate of the parallel survey effect.

7.3 Description of Statistical Modeling

7.3.1 Introduction

Let Y_{it} be a non–seasonally adjusted estimate for a particular labor force measure (e.g., total national unemployment rate) for the ith survey in month t. Here $i = 1$ refers to the CPS and $i = 2$ refers to the parallel survey. In addition, t ranges from 1 to 20, denoting the months October 1992 to May 1994, respectively.

We will consider two models, an *additive factor* model and a *multiplicative factor* model. The additive factor model is given by

$$(1) \qquad Y_{it} = \mu_t + \lambda_i + \sum_{j=1}^{4} \delta_{itj} m_j + e_{it},$$

where

μ_t = True mean for month t,

λ_1 = Effect due to CPS,

λ_2 = Effect due to parallel survey,

δ_{itj} = 1 if m_j occurs in month t and survey i (zero otherwise),

m_1 = Effect due to old method before January 1994,

m_2 = Effect due to new method before January 1994,

m_3 = Effect due to old method since January 1994,

m_4 = Effect due to new method since January 1994,

e_{it} = Sampling error for survey i and month t.

We make the assumption that the sampling errors are normally distributed with mean zero. In addition, the sampling errors are uncorrelated between the two surveys but are correlated within survey. This within-survey correlation is mainly caused by the rotating panel structure of the CPS, mimicked in the parallel survey, which creates a 75 percent overlap between sampled units one month apart and 50 percent overlap between units twelve months apart.

The multiplicative model is given by

$$(2) \qquad \log Y_{it} = \log \mu_t^* + \log \lambda_i^* + \sum_{j=1}^{4} \delta_{itj} \log m_j^* + u_{it},$$

where the parameters are defined analogously to those in equation (1) and the sampling error u_{it} is normally distributed with mean zero.

Our goal with the additive model is to estimate the effect of the new methodology, $\hat{m}_4$ say, in order to create a revised estimate $\hat{Y}_t^{(A)} = Y_{1t} + \hat{m}_4$ for any month before January 1994 that is comparable to data from the CPS since January 1994. Under the multiplicative model we estimate a new methodology effect, $\hat{m}_4^*$, in order to create the revised estimate $\hat{Y}_t^{(M)} = Y_{1t}\hat{m}_4^*$. Unfortunately, the parameters of the models in equations (1) and (2) are not fully identified, even though some linear combinations are identified. For example, if we look at months prior to January 1994 for the additive factor model we get

$$(3) \qquad E\{Y_{2t} - Y_{1t}\} = \lambda_2 - \lambda_1 + m_2 - m_1,$$

while since January 1994 for the additive factor model we get

$$(4) \qquad E\{Y_{2t} - Y_{1t}\} = \lambda_2 - \lambda_1 + m_3 - m_4.$$

The linear combinations in equations (3) and (4) are estimable, even though the individual parameters are not estimable. In order to make progress with respect to individual parameters, additional restrictions need to be imposed.

Basic Assumption

The basic assumption we used is to make everything relative to the CPS prior to January 1994:

$$\begin{aligned} &\text{Additive factor:} \quad \lambda_1 = 0,\ m_1 = 0, \\ &\text{Multiplicative factor:} \quad \lambda_1^* = 1,\ m_1^* = 1. \end{aligned} \tag{5}$$

This brings us down to four free parameters plus twenty monthly mean parameters. Unfortunately, all of the parameters of the model still are not identified. There are several ways to further restrict the parameters, and we list three reasonable ones next.

Restriction 1

In addition to the basic restriction, we could assume that the new method had the same effect before January 1994 as from January 1994 on and that there is no parallel survey effect:

$$\begin{aligned} &\text{Additive factor:} \quad \lambda_2 = 0,\ m_2 = m_4, \\ &\text{Multiplicative factor:} \quad \lambda_2^* = 1,\ m_2^* = m_4^*. \end{aligned} \tag{6}$$

This would allow us to estimate a new method effect and an effect due to the way in which the old methodology was applied from January 1994 forward.

Restriction 2

In addition to the basic restriction, we could assume that the old methodology had the same effect from January 1994 on as it did previously and that there is no parallel survey effect:

$$\begin{aligned} &\text{Additive factor:} \quad \lambda_2 = 0,\ m_3 = 0, \\ &\text{Multiplicative factor:} \quad \lambda_2^* = 1,\ m_1^* = m_3^* = 1. \end{aligned} \tag{7}$$

This would allow us to estimate a new method effect before January 1994 and a new method effect from January 1994 forward.

Restriction 3

In addition to the basic restriction, we could assume that the new methodology had the same effect before January 1994 as it has had since January 1994 and that the old methodology has had the same effect since January 1994 as it had previously:

$$
\text{(8)} \qquad \begin{aligned} &\text{Additive factor:} \quad m_2 = m_4,\ m_3 = 0, \\ &\text{Multiplicative factor:} \quad m_2^* = m_4^*,\ m_1^* = m_3^* = 1. \end{aligned}
$$

This would allow us to estimate a new method effect and a parallel survey effect.

7.3.2 Specification Used in Our Analysis

For the purposes of our analysis we used the additive and multiplicative models in equations (1) and (2) along with the basic assumption (eq. [5]) and restriction 3 (eq. [8]). We chose this specification because it most closely fits our understanding of the data. Specifically, everything possible was done to ensure that the new methodology was applied in the same way in the PSpj and in the CPS since January 1994. In addition, all possible measures were undertaken to ensure that the old method was implemented in the PSsj in the same way it was in the CPS prior to January 1994. The measures taken to ensure that the old and new methods were implemented in 1994 as they had been previously mean that we can estimate one parameter for the new method effect. The addition of a parallel survey effect parameter allows us to use data from 1994 to disentangle the confounding effects of the parallel survey and the new method, which are present if one analyzes only data prior to January 1994.

A variety of evidence both empirical and qualitative also supports use of the specification with a parallel survey effect and a single new method effect. Empirically, as will be discussed below, for the unemployment rate our additive model specification yields an insignificant point estimate of 0.079 for the new method effect and a significant point estimate of 0.41 for the parallel survey effect. Modeling done with employment data from the monthly Current Employment Statistics and unemployment insurance claims data estimating what the national unemployment rate would have been with the unrevised CPS methodology during 1994 also indicates that there was approximately a 0.08 percentage point change in the unemployment rate due to a change in methodology and weights (Tiller and Welch 1994).

A qualitative explanation of why a parallel survey effect might exist, independent of sample design differences, was provided by CPS and parallel survey supervisors in focus groups where they discussed their recent experiences. In these focus groups, some supervisors volunteered that CPS interviewers had larger caseloads than those working on the parallel surveys. The larger CPS caseloads reduced the amount of time interviewers had to follow up on households that did not initially respond. Furthermore, members of the focus groups noted, the smaller caseloads of the parallel survey supervisors gave them more time to monitor the survey process and pursue field problems (Tucker 1994). Differences in following up on nonresponders and monitoring of potential problems between the CPS and the two parallel surveys might have contributed to a parallel survey effect.

There could be some concern that respondents who switched from the revised to the unrevised procedure and vice versa were contaminated by their previous experiences. It should be noted, however, that on average the difference in unemployment rates between surveys from January through May 1994 did not diminish or change signs as would be expected if contamination were affecting the estimates. Therefore, in order to maintain sample size and capture any effect that was peculiar to the households actually selected for the parallel survey prior to January 1994, a decision was made to use the entire sample for January through May 1994, rather than restricting the analysis to households with no previous experience with another methodology.

Finally, we would like to make two other points about the specification we chose. First, even though we are modeling non–seasonally adjusted data, the parameter estimates for the parallel survey effect and new method effect also can be applied to seasonally adjusted data in the following sense. For those data series that are additively seasonally adjusted, we would get the same parameter estimates, with the additive model, for the parallel survey effect and the new method effect if we had used seasonally adjusted or non–seasonally adjusted data (assuming the same variances and covariances were used in the general least squares estimation). This is because the true monthly mean in equation (1) for seasonally adjusted data is just the true mean for the non–seasonally adjusted data plus a unique additive monthly seasonal adjustment factor that can be absorbed into the definition of the mean. A similar situation occurs for series that are multiplicatively seasonally adjusted, if we use the multiplicative model. Again, this occurs because the seasonal adjustment is additive on the scale in which we are modeling (i.e., the seasonal adjustment is additive in the logarithmic scale).

The second point we want to make about the selected specification has to do with why we did not model the underlying true monthly means with some method other than just monthly dummies. For example, it would be possible to specify a polynomial time trend model for the underlying monthly means with splines in time. The specification of such a model would allow us to, in general, identify an additional parameter, for example, freeing up the parameters m_3 and m_3^* in restriction 3. We actually attempted to estimate such models but found the models were still "close" to being not identified in the sense that while we were able to obtain parameter estimates, their standard errors were large and multicollinearity inflated the variance estimates of the parallel survey and new method effects. Thus we chose to continue modeling the monthly means as main effects in the linear model for all of our analyses and gave up trying to identify an additional parameter. In addition, it was felt that using one specification for all of the analyses would help our analysis seem more objective, since we would not have to be engaged in fitting different models for the monthly means, which may have involved the use of additional explanatory variables apart from the CPS and the parallel surveys, such as employment data from the monthly establishment survey (Current Employment Statistics) to model nonagricultural employment.

7.3.3 Estimation

For the model specified above we estimated the remaining parameters by generalized least squares. We illustrate in detail the estimation for the additive model; the estimation for the multiplicative model is analogous. Let $\mathbf{Y}_{(1)}$ be the vector of size 20×1 that contains the consecutive months of data from the CPS from October 1992 to May 1994, let $\mathbf{Y}_{(2)}$ be the data from the parallel surveys, and let $\mathbf{Y}' = (\mathbf{Y}'_{(1)}, \mathbf{Y}'_{(2)})$. Let $\mathbf{X}$ be the 40×22 model matrix associated with the specified model, and let $\boldsymbol{\beta}$ be the 22×1 vector of free parameters. The 22 free parameters consist of 20 monthly means, a parallel survey effect, and a new method effect. Then we can write

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{e}, \tag{9}$$

where $\mathbf{e} \sim \mathbf{N}_{40}(\mathbf{0}, \mathbf{V})$ and $\mathbf{V} = \text{Block}(\mathbf{V}_1, \mathbf{V}_2)$, where $\mathbf{V}_1$ is the 20×20 covariance matrix of the CPS data and $\mathbf{V}_2$ is the 20×20 covariance matrix of the parallel survey data. The matrices $\mathbf{V}_1$ and $\mathbf{V}_2$ are estimated by the method of generalized variances along with correlation estimates obtained from previous CPS research. We will condition on the covariance matrix $\mathbf{V}$ and treat it as known.[5]

The estimated parameters are given by

$$\hat{\boldsymbol{\beta}} = (\mathbf{X}'\mathbf{V}^{-1}\mathbf{X})^{-1}\mathbf{X}'\mathbf{V}^{-1}\mathbf{Y}, \tag{10}$$

and the estimated covariance matrix of the estimates is given by

$$\hat{\mathbf{V}}\{\hat{\boldsymbol{\beta}}\} = (\mathbf{X}'\mathbf{V}^{-1}\mathbf{X})^{-1}.$$

All of the estimations are done with uncomposited data using 1990 population weights. The 1990 population weights are used to obtain a pure estimate of a method effect.[6]

5. Frequently, researchers ignore the complex nature of the sample design for surveys such as the CPS. In practice this will tend to underestimate the variance of most statistics. An illustration of this can be constructed using the non–seasonally adjusted unemployment rate. The estimated standard error from a standard computer package, such as SAS, for the non–seasonally adjusted April 1996 unemployment rate of 5.4 percent was 0.075. In comparison, the estimated standard error from the generalized variance function, which accounts for the complex survey design, for the April 1996 unemployment rate was 0.107. In addition, when analyzing CPS data over time, it is important to account for autocorrelation in monthly estimates. These autocorrelations vary by characteristics. For example, the first-order autocorrelation for the level of unemployment for consecutive months was estimated to be 0.43, while the first-order autocorrelation for the level of employment for consecutive months was estimated to be 0.71.

6. The 1980 weights with modifications for projected growth were used for originally published estimates from 1985 through 1993. In January 1996, the BLS reissued estimates for January 1990 through December 1993 using 1990 weights. No adjustment to official BLS estimates will be made to account for the survey redesign. Appendix C presents the effects of using 1980 vs. 1990 weights for selected 1993 annual average estimates.

7.4 The Results

7.4.1 General

All of the adjustment factors presented in the tables were estimated using the linear model specified above, which includes a new method effect and a parallel survey effect. Standard errors are provided in parentheses below the adjustment factors. Adjustment factors that were significantly different from one for the multiplicative model or zero for the additive model at the 5 percent level are indicated with asterisks. Point estimates for adjustment factors that were not significant are also provided, although when adjustment factors are not significant, depending on the sensitivity of the analysis, one could historically compare data before and after January 1994 without adjustment. Annual averages for 1993 are also included in the tables as a point of reference.

The effect of using the adjustment factors is illustrated graphically for several of the characteristics. The data in these graphs were adjusted multiplicatively. For comparisons over long time periods, multiplicative factors are recommended, since adjustments using multiplicative factors will account for differences in the level of the characteristic at different points in time. It should be noted, however, that for multiplicatively adjusted data, changes over time will not be the same as the changes measured by the unadjusted series. In contrast, the additively adjusted series will change the level of the series while leaving the estimates of change unaffected.

7.4.2 Unemployment and Related Unemployment Estimates

Unemployment Rate

Table 7.1 presents adjustment factors for the unemployment rates for detailed demographic groups. Examination of the adjustment factors in table 7.1 indicates that, unlike what was expected from the PSpj, the new methodology *did not* have a significant effect on the overall unemployment rate, although the point estimate for the additive factor was 0.079 and the point estimate for the multiplicative factor was 1.009, which would be equivalent to an approximately 1 percent increase in the unemployment rate. As could be anticipated from figure 7.1, the parallel survey effect in the linear model for the overall unemployment rate was estimated to be 0.41, which was statistically significant at the 1 percent level.

Further examination of the adjustment factors for the unemployment rates for various demographic groups reveals that the new methodology did not cause a significantly higher unemployment rate for any demographic group except older Americans. Specifically, the adjustment factors for all individuals aged 55–64, all individuals aged 65 or older, men aged 65 or older, women aged 55–64, and women aged 65 or older are each statistically significant and indicate that the revised methodology raised their rates.

Table 7.1 **Unemployment Rate Adjustment Factors for 1994 Methodological Change**

Demographic Group	Multiplicative Factor	Additive Factor	1993 Annual Average
Total 16+	1.009	0.079	6.8
	(0.011)	(0.076)	
Men 16+	1.012	0.10	7.1
	(0.015)	(0.11)	
Women 16+	1.007	0.07	6.5
	(0.016)	(0.11)	
White men 16+	1.029	0.19	6.2
	(0.018)	(0.11)	
White women 16+	1.025	0.15	5.7
	(0.021)	(0.11)	
Black men 16+	0.971	−0.38	13.8
	(0.032)	(0.49)	
Black women 16+	0.965	−0.48	12.0
	(0.031)	(0.43)	
Teenagers (16–19)	1.035	0.65	19.0
	(0.027)	(0.51)	
20–24-year-olds	1.007	0.03	10.5
	(0.026)	(0.28)	
25–54-year-olds	0.985	−0.075	5.8
	(0.014)	(0.084)	
55–64-year-olds	1.121*	0.50*	4.7
	(0.053)	(0.21)	
65 years or older	1.52*	1.52*	3.2
	(0.16)	(0.31)	
Men 16–19 years old	1.029	0.71	20.4
	(0.033)	(0.66)	
Men 20–24 years old	1.024	0.16	11.3
	(0.035)	(0.40)	
Men 25–54 years old	0.985	−0.07	5.9
	(0.019)	(0.12)	
Men 55–64 years old	1.06	0.29	5.2
	(0.06)	(0.30)	
Men 65 years or older	1.69*	1.93*	3.2
	(0.25)	(0.42)	
Women 16–19 years old	1.029	0.58	17.4
	(0.040)	(0.69)	
Women 20–24 years old	0.980	−0.23	9.6
	(0.036)	(0.38)	
Women 25–54 years old	0.990	−0.05	5.6
	(0.020)	(0.12)	
Women 55–64 years old	1.232*	0.76*	4.0
	(0.096)	(0.26)	
Women 65 years or older	1.33*	0.85*	3.1
	(0.19)	(0.44)	
Adult men (20+)	1.005	0.04	6.4
	(0.016)	(0.11)	
Adult women (20+)	1.001	0.016	5.9
	(0.017)	(0.10)	

Note: Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

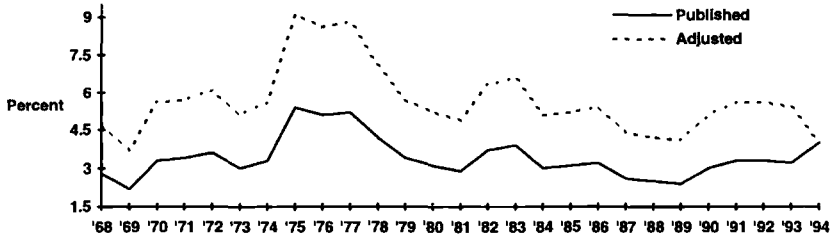

Fig. 7.3 Unemployment rate of men aged 65 or older (multiplicatively adjusted vs. published data)

The higher unemployment rates for older Americans are probably due to a combination of automation and rewording of the questionnaire. One of the most frequently heard complaints from respondents about the unrevised CPS was that it was burdensome and irritating for retired workers who had no attachment to the labor force. To alleviate this burden, the response category "retired" was added to each question about labor force activity. If individuals aged 50 or older volunteer that they are retired in answer to any of these questions, they are skipped directly to a specific question asking whether they currently want a job, either full or part time. Individuals who indicate that they want a job are asked the job search questions to establish if they have been looking for work in order to potentially classify them as unemployed. It could be that by reducing respondent irritation with the survey, directly asking older respondents if they currently want a job after they have said they are retired, and using the "part time" reference could prompt some older individuals to report that they have looked for work. In addition, a lower level of respondent irritation in combination with the automation of the survey could reduce the propensity for interviewers to make a personal assessment of older respondents and inappropriately lead them through the questionnaire.

The effect of applying the multiplicative adjustment factor for men aged 65 or older can be seen in figure 7.3. In addition to noting the dramatic shift in the graph for men aged 65 or older—the multiplicative factor increases the unemployment rate for older men as measured by the unrevised CPS 69 percent—it also is interesting to note that the redesign brings older men's unemployment rate closer to the unemployment rate for prime-aged males. Consequently, as the population ages, the redesign could have an effect on the overall unemployment rate independent of societal and economic changes that may occur.

Reasons for Unemployment

In addition to the unemployment rate, analysts frequently are interested in the reasons individuals are unemployed. The CPS allows unemployed individuals to be classified into one of five reasons for unemployment. Individuals

Table 7.2 **Reasons for Unemployment: Adjustment Factors for 1994 Methodological Change**

Reason for Unemployment	Multiplicative Factor	Additive Factor	1993 Annual Average
Total			
Laid off	0.975	−0.51	12.6
	(0.027)	(0.40)	
Other job losers	0.952*	−1.89*	42.0
	(0.014)	(0.56)	
Job leavers	0.866*	−1.39*	10.8
	(0.027)	(0.31)	
Reentrants to the job market	1.308*	7.79*	24.6
	(0.022)	(0.47)	
New entrants to the job market	0.622*	−4.01*	10.0
	(0.021)	(0.30)	
Men			
Laid off	0.932*	−1.30*	15.0
	(0.031)	(0.57)	
Other job losers	0.974	−1.02	47.7
	(0.017)	(0.76)	
Job leavers	0.910*	−0.88*	9.9
	(0.041)	(0.40)	
Reentrants to the job market	1.354*	6.80*	18.5
	(0.035)	(0.58)	
New entrants to the job market	0.592*	−3.74*	8.9
	(0.029)	(0.39)	
Women			
Laid off	1.068	0.43	9.6
	(0.053)	(0.53)	
Other job losers	0.914*	−2.84*	34.5
	(0.024)	(0.81)	
Job leavers	0.822*	−2.03*	12.0
	(0.037)	(0.49)	
Reentrants to the job market	1.266*	8.85*	32.4
	(0.027)	(0.76)	
New entrants to the job market	0.649*	−4.28*	11.5
	(0.030)	(0.48)	

Note: Numbers are percentages of total unemployed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

could be unemployed because they were laid off from their jobs, lost their jobs for some other reason, voluntarily left their jobs, were reentrants into the job market, or were new entrants in the job market. Table 7.2 provides adjustment factors for these five reasons for being unemployed for all unemployed, unemployed men, and unemployed women, respectively.

Although the new methodology does not seem to have affected the overall unemployment rate, the adjustment factors in table 7.2 suggest that the new methodology did affect the overall composition of individuals' reasons for un-

employment. For all unemployed, the adjustment factors indicate that the new methodology significantly increased the proportion of unemployed classified as reentrants and decreased the proportion of unemployed in the other four reason categories, with the proportions classified as "other job losers," "job leavers," and "new entrants" decreasing significantly. For men, the estimated adjustment factors also indicate that the new methodology significantly decreased the proportion classified as "laid off."

The estimated effect of the new methodology on reentrants is probably related to a combination of questionnaire wording and minor definitional changes. First, the wording of the question where the majority of unemployed provide their reasons for unemployment was changed from "At the time you started looking for work, was it because you lost or quit a job or was there some other reason?" in the unrevised CPS to "*Before* you started looking for work, what were you doing: working, going to school, or something else?" with the follow-up for those who said they were working "Did you lose or quit that job, or was it a temporary job that ended?" in the revised CPS. The wording of the unrevised question may have led those who had previously been employed to gloss over subsequent periods of time in which they were out of the labor market before searching for work. In that case, they would have been classified as job losers or job leavers in the unrevised CPS rather than as reentrants as is required by CPS definitions.[7]

Second, part of the new method effect on the estimate of reentrants can be attributed to a seemingly innocuous definitional change. In the unrevised CPS, individuals were asked when they had last worked full time for two weeks or longer. With this question only individuals who had worked full time were considered to have previous work experience and thus were classified as reentrants. Individuals whose entire work experience was part time or had lasted less than two weeks were classified as new entrants. The wording in the revised CPS was broadened to take into account any type of previous work experience, which should serve to reduce the proportion of unemployed classified as new entrants and increase the proportion classified as reentrants.

Finally, the proportion classified as reentrants could be affected by a change in the implementation of the on layoff concept. According to the official CPS definition, individuals must expect to be recalled to be classified as laid off. However, the unrevised CPS did not verify whether individuals who said they were laid off expected to be recalled. After asking a direct question about whether an individual is laid off, the revised CPS verifies whether individuals expect to be recalled through a series of two questions. Respondents are first asked if they were given a date to be recalled. If they say no, respondents are then asked if they expect to be recalled in the next six months. Only individuals

7. It should be noted that in the CPS information is collected on how long it has been since an individual last worked. However, according to the CPS definition, previously employed individuals should be classified as reentrants if there was a period during which they were out of the labor market, regardless of the duration of this period.

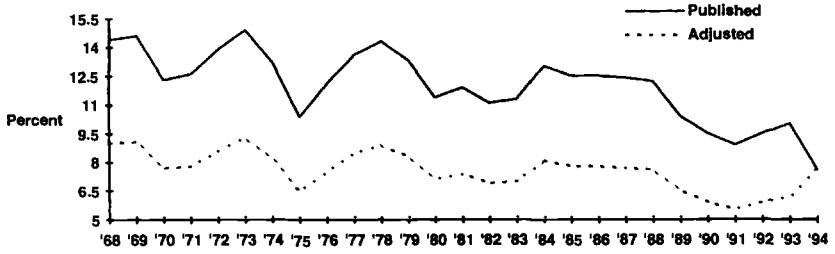

Fig. 7.4 New entrants as a percentage of unemployed (multiplicatively adjusted vs. published data)

who indicate either that they were given a recall date or that they expect to be recalled in the next six months are classified as laid off in the revised CPS. Those who do not meet the layoff criteria continue to the job search questions. Consequently, even those who do not expect to be recalled have an opportunity to be classified as unemployed in the revised CPS. For men, the adjustment factors indicate that the expectation of recall questions did screen respondents from being classified as laid off. However, the lack of significant adjustment factors for men's unemployment rates seems to indicate that the recall expectation questions did not have an effect on men's overall rate of unemployment.

Figure 7.4 plots adjusted and unadjusted series for new entrants.

Duration of Unemployment

The distribution of the length of time individuals have been unemployed is one indicator of the economy's relative position in a business cycle. In addition, economists examine the duration of unemployment spells to obtain a measure of economic hardship and to test alternative theories about the effects of unemployment insurance or reservation wages. Table 7.3 presents adjustment factors for the proportion of the unemployed who have been unemployed less than 5 weeks, 5 to 14 weeks, and 15 weeks or more.

Examination of the adjustment factors in table 7.3 reveals that the new methodology significantly increased the proportion of unemployed who had long spells of unemployment and significantly decreased the proportion of unemployed with spells of unemployment less than 5 weeks. The 17 percent change between the revised and unrevised questionnaire in the proportion of the unemployed reported to be without work 15 weeks or longer probably can be attributed to two methodological changes.

The first change involved the use of dependent interviewing. Previous research indicated that the duration of unemployment was not reported consistently for individuals who had been unemployed in consecutive months. (Polivka and Rothgeb 1993). Results collected using the unrevised CPS from November 1992 through December 1993 verified this previous research. Specifically, when unemployment durations were collected independently using

Table 7.3 **Duration of Unemployment: Adjustment Factors for 1994 Methodological Change**

Duration of Unemployment	Multiplicative Factor	Additive Factor	1993 Annual Average
Less than 5 weeks	0.830*	−6.32*	36.2
	(0.011)	(0.46)	
5–14 weeks	1.014	0.36	28.9
	(0.016)	(0.49)	
15 weeks and over	1.169*	5.58*	34.9
	(0.019)	(0.54)	

Note: Numbers are percentages of total unemployed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

the unrevised procedures each month, only 26.1 percent of those unemployed in consecutive months increased their reported durations by four weeks plus or minus a week. Only 15.3 percent increased their length of unemployment by exactly four weeks. Approximately 46 percent of those unemployed in consecutive months reported a duration in the subsequent month that was less than three weeks greater than the duration reported in the previous month, and 28.5 percent reported a duration that was more than five weeks greater than the length of unemployment reported in the previous month.

In the revised CPS, these reporting inconsistencies were eliminated through the use of dependent interviewing and automatic updating. Rather than being asked each month how long they had been unemployed, individuals who were looking for work or laid off in consecutive months had their initially reported durations automatically increased by four or five weeks in the subsequent months.[8] The choice of adding four or five weeks was based on the number of weeks between surveys.

The second methodological change that probably influenced the reported duration of unemployment involved the reduction of response burden for the longer term unemployed. In the unrevised CPS, respondents were forced to report how long they had been looking for work or laid off in weeks. Research by Bowers and Horvath (1984) found that forcing respondents to report in weeks resulted in underreporting of durations for those with spells of unemployment lasting 26 weeks or longer. In the revised CPS, respondents are permitted to report their durations of joblessness in weeks, months, or years as they prefer. To incorporate this change the question wording was changed from "How many weeks have you been looking for work?" ("How many weeks ago were you laid off?") to "As of the end of *last week,* how long had you been

8. This methodology could smooth over short jobs held between monthly interviews. However, direct questioning conducted from July 1991 to October 1991 during the testing of the revised CPS indicated that only 3.2 percent of those who said they were looking for work in consecutive months had worked between interviews.

looking for work?" ("As of the end of *last week,* how long had you been on layoff?")

There is evidence that the choice of reporting periodicity and alternative wording in the revised questionnaire increased the reported durations of unemployment, independent of the effect of dependent interviewing. Specifically, the average duration of unemployment from November 1992 through December 1993 for those who were either in their first or fifth monthly interviews or not unemployed in consecutive months was 14.96 weeks for those who received the unrevised CPS and 17.19 weeks for those who received the revised procedures. In addition, in January 1994 when there was no dependent interviewing in the revised CPS, the proportion of unemployed whose durations were 15 weeks or longer was 34.23 percent for those who received the revised procedures in the CPS compared to 29.3 percent for those who received the unrevised procedures in the parallel survey.

Industry and Occupation of the Unemployed

In addition to variations in the measurement of unemployment in the aggregate and for various demographic groups, analysts are also interested in the cyclical behavior of unemployment within various industries and occupations. To facilitate comparisons after the redesign, table 7.4 presents adjustment factors for the proportion of unemployed with previous work experience in nine broad industry categories, and table 7.5 provides adjustment factors for the proportion of unemployed in six broad occupation groups.[9]

The adjustment factors in table 7.4 indicate that the new methodology significantly increased the proportion of unemployed with previous work experience who had worked in the agriculture and service industries and significantly decreased the proportion who had worked in the manufacturing sector. Figure 7.5 plots adjusted and unadjusted series for the proportion of unemployed with previous work experience in the manufacturing sector.

The almost 9 percent decrease in the proportion of unemployed who worked in the manufacturing sector documented in figure 7.5, along with the almost 9 percent increase in the proportion of unemployed who worked in the service sector, suggests that not accounting for the redesign could distort comparisons over time of slack demand within industries.

The adjustment factors for the occupations of the unemployed with previous work experience indicate that the new methodology increased the proportion classified as having worked in the farming, forestry, and fishing occupation by 19 percent. None of the other occupational adjustment factors were significant at the 5 percent level.

The changes between the new and old methodologies in the industry and occupation distributions of the unemployed with previous work experience are probably due to a combination of factors. As was previously noted, the new

9. Unemployed individuals who were classified as new entrants to the labor market or whose immediate work experience was in the military were excluded from the analysis.

Table 7.4 **Industry of the Unemployed: Adjustment Factors for 1994 Methodological Change**

Industry	Multiplicative Factor	Additive Factor	1993 Annual Average
Agriculture	1.264*	0.69*	3.0
	(0.088)	(0.19)	
Mining	0.79	−0.105	0.7
	(0.13)	(0.081)	
Construction	0.981	−0.26	12.3
	(0.029)	(0.37)	
Manufacturing	0.910*	−1.57*	19.1
	(0.023)	(0.46)	
Transportation and public utilities	0.979	−0.10	5.2
	(0.051)	(0.26)	
Wholesale and retail trade	0.980	−0.43	25.4
	(0.020)	(0.53)	
Finance, insurance, and real estate	0.941	−0.19	4.1
	(0.057)	(0.21)	
Services	1.089*	2.50*	27.9
	(0.020)	(0.54)	
Public administration	0.848*	−0.30	2.4
	(0.062)	(0.19)	

Note: Numbers are percentages of total unemployed who had previous work experience. Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

Table 7.5 **Occupation of the Unemployed: Adjustment Factors for 1994 Methodological Change**

Occupation	Multiplicative Factor	Additive Factor	1993 Annual Average
Managerial and professional specialty	1.009	0.23	12.7
	(0.033)	(0.39)	
Technical, sales, and administrative support	0.986	−0.39	26.8
	(0.019)	(0.53)	
Service occupations	1.049	0.87	17.6
	(0.026)	(0.46)	
Precision production, craft, and repair	0.952	−0.72	14.8
	(0.028)	(0.42)	
Operators, fabricators, and laborers	0.973	−0.65	24.3
	(0.020)	(0.51)	
Farming, forestry, and fishing	1.190*	0.71*	3.8
	(0.071)	(0.22)	

Note: Numbers are percentages of total unemployed who had previous work experience. Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

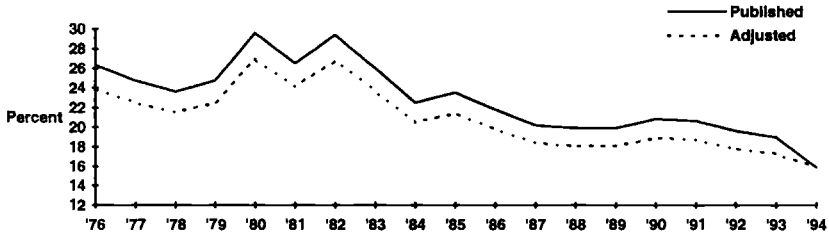

Fig. 7.5 Unemployed who had worked in manufacturing as a percentage of unemployed who had previous work experience (multiplicatively adjusted vs. published data)

methodology was estimated to cause a smaller proportion of the unemployed to be classified as new entrants. A decline in the proportion of unemployed classified as new entrants would cause an increase in the proportion of the unemployed classified as having previous work experience, which in turn could influence the industry and occupation distributions of the unemployed with previous work experience.

Other changes in the revised questionnaire such as an explicit probe about the existence of a family business or farm and the reordering of the questions asking unemployed individuals about the industry and occupation of their previous employment also could have affected the industry and occupation distributions of the unemployed.

7.4.3 Employment and Related Employment Estimates

Employment-to-Population Ratios

Table 7.6 presents adjustment factors for employment-to-population ratios for various demographic groups. Examination of the adjustment factors indicates that the new methodology significantly raised the overall employment-to-population ratio; however, the estimated adjustment factors also indicate that the overall effect masked differences by gender. Specifically, the multiplicative adjustment factors for all men, black men, and men aged 20–24 were significantly less than one at the 5 percent significance level, and the additive factors were negative and statistically different from zero at the 5 percent level. These results suggest that the new methodology significantly lowered the employment-to-population ratios for these groups. In contrast, the estimated adjustment factors indicate that the new method would significantly raise the employment-to-population ratios for women, white women, women aged 25–54, women aged 55–64, and women aged 65 or older. The only group that did not follow this pattern was men aged 65 or older. Using the estimated adjustment factor to account for the new methodology would significantly raise the employment-to-population ratio for these men.

Table 7.6 **Employment-to-Population Ratio: Adjustment Factors for 1994 Methodological Change**

Demographic Group	Multiplicative Factor	Additive Factor	1993 Annual Average
Total 16+	1.0053*	0.33*	61.6
	(0.0017)	(0.10)	
Men 16+	0.9964*	−0.25*	69.9
	(0.0020)	(0.14)	
Women 16+	1.0156*	0.84*	54.1
	(0.0025)	(0.13)	
White men 16+	0.9967	−0.23	71.3
	(0.0025)	(0.18)	
White women 16+	1.0169*	0.92*	54.7
	(0.0030)	(0.16)	
Black men 16+	0.9831*	−1.02*	59.1
	(0.0089)	(0.53)	
Black women 16+	1.0093	0.48	50.5
	(0.0089)	(0.45)	
Teenagers (16–19)	1.005	0.21	41.7
	(0.011)	(0.45)	
20–24-year-olds	0.9920	−0.55	69.0
	(0.0056)	(0.38)	
25–54-year-olds	1.0035*	0.27	78.7
	(0.0018)	(0.14)	
55–64-year-olds	1.0124	0.65	53.8
	(0.0075)	(0.39)	
65 years or older	1.078*	0.84*	10.9
	(0.019)	(0.20)	
Men 16–19 years old	0.988	−0.41	42.2
	(0.014)	(0.60)	
Men 20–24 years old	0.9815*	−1.38*	73.8
	(0.0068)	(0.51)	
Men 25–54 years old	0.9969	−0.27	87.1
	(0.0019)	(0.16)	
Men 55–64 years old	0.9927	−0.44	63.1
	(0.0089)	(0.55)	
Men 65 years or older	1.062*	0.88*	15.1
	(0.025)	(0.36)	
Women 16–19 years old	1.025	0.97	41.2
	(0.017)	(0.68)	
Women 20–24 years old	1.0047	0.30	64.4
	(0.0079)	(0.50)	
Women 25–54 years old	1.0110*	0.77*	70.5
	(0.0027)	(0.19)	
Women 55–64 years old	1.032*	1.47*	45.4
	(0.011)	(0.47)	
Women 65 years or older	1.098*	0.77*	7.9
	(0.027)	(0.20)	
Adult men (20+)	0.9970	−0.21	72.0
	(0.0024)	(0.18)	
Adult women (20+)	1.0150*	0.83*	55.0
	(0.0029)	(0.16)	

Note: Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

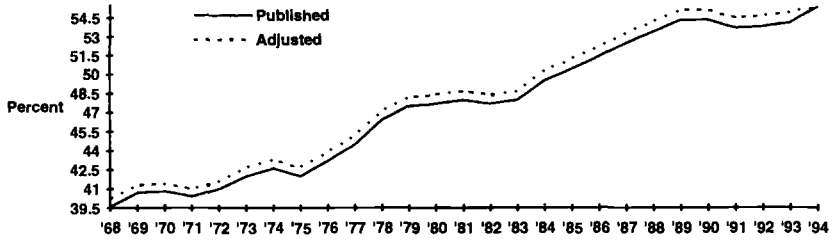

Fig. 7.6 Women's employment-to-population ratio (multiplicatively adjusted vs. published data)

The effect of the new methodology on women's and older workers' employment-to-population ratios probably is at least partially attributable to changes in wording of the questionnaire. These changes include the elimination of the opening labor force question inquiring about major activities last week, which may have caused some respondents to think that the CPS was not interested in more casual or intermittent work activity; the rephrasing of the questions asking about work activities last week to specifically refer to any work for pay and to remove the phrase "not counting work around the house"; and the addition of an explicit question about employment in family businesses.[10]

Figure 7.6 plots both adjusted and unadjusted employment-to-population ratios for women. The increase in women's employment-to-population ratio may not seem large; however, the increase implied by the multiplicative factor is equivalent to approximately 750,000 women.

Part-Time Workers and Workers Who Are Part Time for Economic Reasons

In addition to the proportion of the population employed, economists, sociologists, and policy analysts are also interested in the percentage of the employed who are working part time and the percentage of the employed who are part time for economic reasons such as poor business conditions or the inability to find full-time work. Table 7.7 provides adjustment factors to account for the effect of the new methodology on the number of part-time workers and workers who are part time for economic reasons.

The adjustment factors for part-time workers imply that the unrevised CPS either was not completely enumerating individuals who were working part time or was misclassifying them. Specifically, the multiplicative adjustment factors indicate that the unrevised CPS underestimated the proportion of employed who were working part time by 9.8 percent. The adjustment factors

10. See Cohany et al. (1994), Polivka (1994), and Rothgeb (1994) for a more detailed discussion of why women's employment-to-population ratios may be larger with the new methodology. See Martin and Polivka (1995) for a discussion of the difficulty of measuring work and employment in household surveys.

Table 7.7 **Part-Time Workers and Economic Part-Time Workers: Adjustment Factors for 1994 Methodological Change**

Demographic Group	Multiplicative Factor	Additive Factor	1993 Annual Average
Part-time workers			
Total	1.0983*	1.73*	17.5
	(0.0080)	(0.13)	
Adult men	1.074*	0.65*	8.5
	(0.016)	(0.13)	
Adult women	1.1246*	2.81*	22.8
	(0.0094)	(0.20)	
Teenagers	1.0329*	2.35*	67.7
	(0.0092)	(0.64)	
Part-time workers for economic reasons	0.806*	−1.003*	5.3
	(0.011)	(0.062)	

Note: Numbers are percentages of total employed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

further indicate that this incomplete enumeration or misclassification occurred across various age and gender groups, since the multiplicative and additive factors for adult men, adult women, and teenagers all are significantly different from one and zero, respectively, at the 5 percent level.

Part of the estimated effect of the new methodology on the proportion of employed classified as part-time workers could be due to the elimination of a misclassification caused by the structure of the unrevised CPS. In the unrevised CPS, only individuals who actually worked less than 35 hours in the reference week were asked how many hours they usually worked. All individuals who were at work 35 hours or more were automatically classified as full time, regardless of the number of hours they usually worked. In the revised CPS, all respondents are first asked how many hours they usually work and then asked in subsequent questions about their actual hours. The new methodology could also increase the proportion of employed workers classified as part time if the additional workers measured in the revised CPS, as evidenced by the revised CPS's higher employment-to-population ratios, were disproportionately part-time workers.

At the same time that the adjustment factors imply that the new methodology increases the percentage of the employed working part time, they also indicate that the new methodology would decrease the proportion of the employed classified as part time for economic reasons by approximately 20 percent. The reduction in the proportion of the employed classified as part time for economic reasons most likely occurred because the unrevised CPS did not directly ask people if they wanted to and were available to work full time. Rather, individuals' desire and availability to work full time were assumed

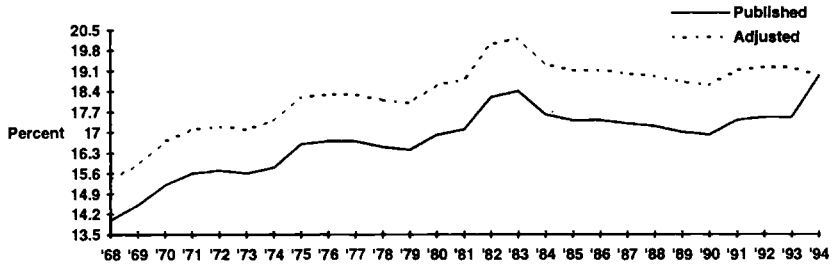

Fig. 7.7 Part-time workers as a percentage of employed (multiplicatively adjusted vs. published data)

Fig. 7.8 Workers who are part time for economic reasons as a percentage of employed (multiplicatively adjusted vs. published data)

from the reasons they gave for working part time. In the revised CPS, individuals are asked directly if they want to and are available to work full time. In addition, part of the decrease in the proportion of employed working part time for economic reasons with the new methodology could be attributable to the more complete measurement of part-time workers in the revised CPS.

Figures 7.7 and 7.8 plot multiplicatively adjusted versus published data for part-time workers and workers who are part time for economic reasons, respectively. The sharp jumps in the unadjusted data highlight the importance of adjusting the CPS data for the redesign when making comparisons over time. Failure to adjust the data could cause analysts to reach improper policy conclusions about societal or economic changes that may or may not have occurred between the early 1990s and later years.

Class of Worker

Using the CPS data, employed individuals can be classified as wage and salary workers who work in the private sector, wage and salary workers who work for the government, self-employed incorporated, self-employed unincorporated, and unpaid family workers. Table 7.8 contains adjustment factors for these class-of-worker categories, along with factors for self-employed incorporated and self-employed unincorporated combined and for all wage and salary

Table 7.8 **Class of Worker: Adjustment Factors for 1994 Methodological Change**

Class of Worker	Multiplicative Factor	Additive Factor	1993 Annual Average
Total			
Wage and salary, private	0.9925*	−0.55*	72.6
	(0.0018)	(0.14)	
Wage and salary, government	0.9783*	−0.34*	15.5
	(0.0070)	(0.11)	
Self-employed incorporated	1.160*	0.462*	3.0
	(0.022)	(0.058)	
Self-employed unincorporated	1.062*	0.486*	8.7
	(0.012)	(0.091)	
Self-employed unincorporated and incorporated	1.088*	0.95*	11.7
	(0.011)	(0.11)	
Unpaid family workers	0.750*	−0.057*	0.3
	(0.062)	(0.015)	
Wage and salary and self-employed incorporated	0.99535*	−0.429*	91.1
	(0.00089)	(0.083)	
Men			
Wage and salary, private	0.9965	−0.26	71.7
	(0.0025)	(0.18)	
Wage and salary, government	0.986	−0.18	13.0
	(0.011)	(0.14)	
Self-employed incorporated	1.099*	0.401*	4.3
	(0.023)	(0.087)	
Self-employed unincorporated	1.004	0.03	10.9
	(0.013)	(0.13)	
Self-employed unincorporated and incorporated	1.031*	0.44*	15.2
	(0.011)	(0.15)	
Unpaid family workers	0.93	−0.007	0.1
	(0.13)	(0.013)	
Wage and salary and self-employed incorporated	0.9996	−0.04	89.0
	(0.0014)	(0.12)	
Women			
Wage and salary, private	0.9881*	−0.88*	73.6
	(0.0025)	(0.19)	
Wage and salary, government	0.9677*	−0.61*	18.5
	(0.0086)	(0.17)	
Self-employed incorporated	1.368*	0.547*	1.4
	(0.049)	(0.060)	
Self-employed unincorporated	1.184*	1.02*	6.0
	(0.022)	(0.11)	
Self-employed unincorporated and incorporated	1.22*	1.58*	7.5
	(0.02)	(0.12)	
Unpaid family workers	0.673*	−0.120*	0.4
	(0.058)	(0.024)	
Wage and salary and self-employed incorporated	0.9902*	−0.925*	93.5
	(0.0010)	(0.098)	

Note: Numbers are percentages of total employed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

workers. In addition, since the BLS publishes estimates that classify the self-employed incorporated as wage and salary workers, adjustment factors for wage and salary workers and the self-employed incorporated combined are also provided.

The adjustment factors in table 7.8 indicate that under the new methodology, a significantly higher proportion of the total employed and employed women were classified as self-employed incorporated and self-employed unincorporated. At the same time a significantly smaller proportion were classified as wage and salary workers—either government or private—and unpaid family workers. The larger proportion of employed classified as self-employed incorporated and unincorporated with the new methodology is probably due to a combination of changes incorporated into the revised questionnaire. These include a direct question about household businesses at the beginning of the labor force questions, the reordering of the class-of-worker and industry and occupation questions to prevent interviewers from entering responses without asking all the appropriate questions, and the general changes in the measurement of employment embodied in the revised CPS.

Industry and Occupation of the Employed

In addition to determining whether individuals are wage and salary workers or self-employed, the CPS also collects information about the industry and occupation in which people work. Table 7.9 contains adjustment factors for the proportion of the employed who were classified as working in one of nine broad industry categories. Table 7.10 presents adjustment factors for the proportion of the employed who were reported as working in one of six major occupation groups.

Examination of the adjustment factors in table 7.9 indicates that the new methodology significantly increased the proportion of the employed classified as working in the agriculture, manufacturing, and finance, insurance, and real estate industries. The adjustment factors also indicate that at the 5 percent level, the new methodology significantly decreased the proportion of the employed classified as working in the construction and transportation and public utilities industries.

The adjustment factors for the proportion of the employed working in various occupations indicate that the new methodology significantly increased the proportion classified in the managerial and professional specialty group and significantly decreased the proportion of the employed classified as working as an operator, fabricator, or laborer.

Shifts between the revised and the unrevised CPS in the industry and occupation distributions of the employed are probably attributable to a combination of methodological differences. Again, as with the class-of-worker distribution, the industry and occupation distributions could be influenced by the different ordering of the class-of-worker and industry and occupation questions and by the inclusion of a direct probe about the existence of a household business

Table 7.9 **Industry of the Employed: Adjustment Factors for 1994 Methodological Change**

Industry	Multiplicative Factor	Additive Factor	1993 Annual Average
Agriculture	1.088*	0.195*	2.6
	(0.024)	(0.051)	
Mining	1.078	0.028	0.6
	(0.056)	(0.019)	
Construction	0.960*	−0.247*	6.1
	(0.013)	(0.081)	
Manufacturing	1.0197*	0.33*	16.4
	(0.0069)	(0.11)	
Transportation and public utilities	0.976*	−0.177*	7.1
	(0.011)	(0.079)	
Wholesale and retail trade	0.9925	−0.16	20.8
	(0.0059)	(0.12)	
Finance, insurance, and real estate	1.015	0.099	6.7
	(0.012)	(0.075)	
Services	0.9987	−0.05	35.1
	(0.0041)	(0.15)	
Public administration	0.991	−0.042	4.8
	(0.014)	(0.064)	

Note: Numbers are percentages of total employed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

Table 7.10 **Occupation of the Employed: Adjustment Factors for 1994 Methodological Change**

Occupation	Multiplicative Factor	Additive Factor	1993 Annual Average
Managerial and professional specialty	1.0155*	0.42*	27.1
	(0.0050)	(0.14)	
Technical, sales, and administrative support	0.9947	−0.17	30.9
	(0.0048)	(0.15)	
Service occupations	0.9983	−0.02	13.8
	(0.0078)	(0.11)	
Precision production, craft, and repair	0.9837	−0.18	11.2
	(0.0089)	(0.10)	
Operators, fabricators, and laborers	0.9805*	−0.28*	14.3
	(0.0076)	(0.11)	
Farming, forestry, and fishing	1.082*	0.196*	2.8
	(0.026)	(0.058)	

Note: Numbers are percentages of total employed. Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

or farm in the revised questionnaire. In addition, the industry and occupation distributions of the employed could be affected by the increase in work activity, particularly among women, measured in the revised questionnaire.

Another change in the industry and occupation questions is that after occupation information is collected in the first and fifth monthly personal interviews, in successive months individuals are asked if they work for the same employer and have the same job duties as they initially reported. Individuals who indicate that there were no changes simply are asked to verify the industry and occupation information they previously provided; the information is not collected anew. This dependent interviewing technique should have little effect on the level of employment within industries and occupations, but it will affect estimates of change, especially at the more detailed level. When information was collected independently each month in the unrevised CPS, in a test conducted from July 1991 to October 1991, it was estimated that at the three-digit level, 23 percent of respondents changed industry and 39 percent changed occupations month to month. Using the revised methodology it was estimated that during the same time period, 5 percent of individuals changed industries and 7 percent changed occupations. True measures of change generated for about the same time period were 3.8 to 4.2 percent for industry and 5.9 to 7.4 percent for occupation (Polivka and Rothgeb 1993).

7.4.4 Labor Force Participation and Discouraged Workers

Labor Force Participation Rates

Table 7.11 presents multiplicative and additive adjustment factors for the labor force participation rate—the proportion of the population that is either employed or unemployed—for various demographic groups. In general, the adjustment factors for the labor force participation rates follow the pattern one would expect after examining adjustment factors for both unemployment rates and employment-to-population ratios. The estimated factors indicated that the new methodology would significantly raise the labor force participation rates of all women, white women, and women in every age category except 20–24. In contrast, the adjustment factors suggest that the new methodology would significantly lower the labor force participation rates of men aged 20–24 and 25–54.

Discouraged Workers

In the unrevised CPS, individuals who were not in the labor force, wanted jobs, but had not looked for work in the prior month because they believed no jobs were available were defined as discouraged workers. Discouraged workers have been the focus of attention in the past as one indicator of the economy's health and as a group of individuals who may be suffering particular economic hardship. Nevertheless, the definition of discouraged workers in the unrevised CPS has frequently been criticized. The National Commission on Employment

Table 7.11 **Labor Force Participation Rate: Adjustment Factors for 1994 Methodological Change**

Demographic Group	Multiplicative Factor	Additive Factor	1993 Annual Average
Total 16+	1.0064*	0.423*	66.2
	(0.0014)	(0.093)	
Men 16+	0.9979	−0.16	75.2
	(0.0022)	(0.16)	
Women 16+	1.016*	0.95*	57.9
	(0.0027)	(0.15)	
White men 16+	0.9988	−0.08	76.1
	(0.0022)	(0.17)	
White women 16+	1.0194*	1.12*	58.0
	(0.0031)	(0.17)	
Black men 16+	0.9885	−0.83	68.6
	(0.0076)	(0.52)	
Black women 16+	0.9990	−0.04	57.4
	(0.0076)	(0.45)	
Teenagers (16–19)	1.0173*	0.90*	51.5
	(0.0090)	(0.44)	
20–24-year-olds	0.9941	−0.46	77.1
	(0.0044)	(0.34)	
25–54-year-olds	1.0024	0.20	83.5
	(0.0015)	(0.12)	
55–64-year-olds	1.0190*	1.04*	56.4
	(0.0071)	(0.38)	
65 years or older	1.094*	1.03*	11.3
	(0.019)	(0.20)	
Men 16–19 years old	1.004	0.24	53.1
	(0.012)	(0.60)	
Men 20–24 years old	0.9847*	−1.30*	83.1
	(0.0053)	(0.45)	
Men 25–54 years old	0.9960*	−0.37*	92.6
	(0.0015)	(0.14)	
Men 55–64 years old	0.9961	−0.25	66.5
	(0.0087)	(0.56)	
Men 65 years or older	1.084*	1.25*	15.6
	(0.026)	(0.38)	
Women 16–19 years old	1.033*	1.67*	49.9
	(0.014)	(0.65)	
Women 20–24 years old	1.0049	0.35	71.3
	(0.0066)	(0.46)	
Women 25–54 years old	1.0099*	0.74*	74.7
	(0.0024)	(0.18)	
Women 55–64 years old	1.043*	2.03*	47.3
	(0.01)	(0.47)	
Women 65 years or older	1.106*	0.85*	8.2
	(0.026)	(0.20)	
Adult men (20+)	0.9975	−0.20	76.9
	(0.0022)	(0.17)	
Adult women (20+)	1.0153*	0.90*	58.4
	(0.0027)	(0.16)	

Note: Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

Table 7.12 **Discouraged Workers: Adjustment Factors for 1994 Methodological Change**

	Multiplicative Factor	Additive Factor	1993 Annual Average
Total	0.500*	−0.782*	1.72
	(0.011)	(0.025)	

Note: Numbers are percentages of those not in the labor force. Numbers in parentheses are standard errors.

*Significant at the 5 percent level.

and Unemployment Statistics faulted the definition for being too subjective because it was based primarily on individuals' desire for work rather than on more objective criteria such as recent job search. The definition in the unrevised CPS also has been criticized because individuals' information about availability for work was inferred from their reasons for not looking. To address the commission's concerns, two new requirements were added to the definition in the revised CPS questionnaire. To be classified as discouraged under the new methodology, individuals must have engaged in some job search within the past year (or since they last worked if they have worked within the past year) and must currently be available to take a job, in addition to the old criteria of currently wanting a job and having given up looking for reasons related to the economy.[11] The adjustment factors for discouraged workers, contained in table 7.12, indicate that the two additional criteria in the revised CPS decreased the proportion of those not in the labor force classified as discouraged workers by 50 percent.

7.5 Conclusion

The purpose of this paper was to provide adjustment factors in order that individuals could continue to use CPS data historically after the redesign. In addition, the adjustment factors were examined to provide insight into how the unrevised CPS might have been providing a distorted picture of the American economy. Overall, the adjustment factors suggest that the unrevised CPS was not mismeasuring individuals who were working full time in steady jobs or the vast majority of individuals looking for work—those in the center of the lens, so to speak. Rather, the adjustment factors indicate that the unrevised CPS was less in focus for those on the periphery of the labor market—those involved in more casual, intermittent, or marginal work activities, individuals who might have tentatively tested the labor market, and older workers. The adjustment

11. Also starting in January 1994, the series of questions that potentially classifies those not in the labor force as discouraged is asked of the entire CPS sample, rather than being limited to individuals in their fourth and eighth monthly interviews as was done in the past.

factors also imply that the unrevised CPS was not measuring as accurately as possible some of the characteristics of the employed and the unemployed. Specifically, the adjustment factors suggest that the unrevised CPS underestimated the proportion of employed who were part-time workers, overestimated the proportion of employed who were part time for economic reasons, and mismeasured individuals' reasons for being unemployed. By providing adjustment factors, it is hoped that a clearer picture of the economy through a redesigned CPS can be obtained without precluding comparisons of CPS estimates over time.

Appendix A
Note on Using the Adjustment Factors

Aggregation

The adjustment factors presented in tables 7.1 through 7.12 were estimated to be optimal for the statistic specified. In order to obtain a set of estimates that are consistent for both an overall statistic and mutually exclusive subgroups beneath the overall statistic (e.g., the total unemployment rate, adult men's unemployment rate, adult women's unemployment rate, and teenagers' unemployment rate), it would be necessary to subdivide the population into the lowest level of mutually exclusive subgroups for whom consistent estimates are desired and then adjust the component levels that are used for calculating the statistics for each of the subgroups (e.g., employment levels, unemployment levels, and, by subtraction from the population estimates, not in labor force levels). Once the adjusted levels for the subcategories have been obtained, consistent estimates for the statistics of interest for the subgroups and the aggregate could be derived. It is important to note, however, that enforcing consistency would not necessarily result in the same adjusted aggregate statistics as would be obtained if the aggregate statistic had been adjusted directly. The issues of aggregation surrounding the adjustment factors for the redesign are similar to those surrounding the aggregation and estimation of seasonally adjusted statistics. For statistics that the BLS seasonally adjusts, consistent estimates are obtained by first seasonally adjusting levels for subgroups and then aggregating. Adjustment factors for the 12 basic labor force series that are seasonally adjusted to obtain the seasonally adjusted total national unemployment rate are provided in appendix B. A comparison of what the annual unemployment rate would have been in 1992 if the multiplicative adjustment factor for the redesign had been applied directly as opposed to adjusting the subgroups first is also provided in appendix B. It should be noted that the estimates differ by only 0.03 percentage points.

Microdata Weighting

Our primary concern has been to develop adjustment factors, both additive and multiplicative, for aggregate series. Undoubtedly, some researchers will want "adjusted microdata weights" so that they can do analyses that are comparable before and after the redesign. A tempting way to do this is next described by example. First partition the population into men aged 16–19, men aged 20+, women aged 16–19, and women aged 20+ and cross these classifications with the labor force categories unemployed, employed in agriculture, employed in nonagricultural industries, and not in labor force. Multiplicative adjustment factors for 12 of these are given in appendix B. Implied adjustment factors for the remaining four not-in-labor-force categories could be obtained by taking the adjusted not-in-labor-force total (obtained by subtracting the adjusted labor force total from the unadjusted population count for each group) and dividing that by the unadjusted not-in-labor-force total. This ratio would be different for any given month (unlike the direct adjustment factors for unemployment and employment) because not in labor force is obtained indirectly by subtraction from the population total, which is assumed fixed and not subject to adjustment. Once the 16 multiplicative adjustment factors are obtained, they could be applied to the sampling weights for each of the respondents within each of the 16 groups, producing "adjusted microdata weights." Then the sum of all of the respondents within each of the 16 groups, using the adjusted microdata weights, would equal the multiplicatively adjusted aggregate total by the distributive law. While this may be tempting, we do not recommend using these microdata weights for any analyses other than constructing totals for each of those 16 groups since there is no guarantee that these weights would have any meaning if used in more complicated analyses.

Appendix B

Table 7B.1 below contains adjustment factors for the 12 series that are seasonally adjusted and then aggregated together to obtain a seasonally adjusted total national unemployment rate. Adjusted levels of those not in the labor force could be obtained by subtraction from the population estimates for the given characteristic.

The 1992 annual average unemployment rate obtained when the levels for the subgroups were adjusted and the unemployment rate was then calculated was 7.45 percent. The 1992 annual average unemployment rate when the multiplicative adjustment factors in table 7.1 were applied directly was 7.47 percent.

Table 7B.1 **Unemployment and Employment Levels: Adjustment Factors for 1994 Methodology Change**

Characteristic	Multiplicative Factor	Additive Factor
Unemployed teenage men	1.030	20,963
	(0.036)	(26,192)
Unemployed teenage women	1.063	44,656
	(0.044)	(25,338)
Unemployed adult men	1.0024	12,765
	(0.016)	(70,595)
Unemployed adult women	1.018	62,617
	(0.017)	(58,405)
Teenage men employed in agriculture	1.076	10,340
	(0.094)	(13,515)
Teenage women employed in agriculture	1.034	−1,799
	(0.18)	(6,861)
Adult men employed in agriculture	1.042	80,156
	(0.024)	(47,058)
Adult women employed in agriculture	1.326*	175,713*
	(0.057)	(24,904)
Teenage men employed in nonagriculture	0.986	−32,305
	(0.017)	(48,911)
Teenage women employed in nonagriculture	1.022	56,280
	(0.020)	(53,558)
Adult men employed in nonagriculture	0.9956*	−263,973*
	(0.0023)	(138,281)
Adult women employed in nonagriculture	1.012*	627,993*
	(0.0026)	(135,314)

Note: Numbers in parentheses are standard errors.
*Significant at the 5 percent level.

Appendix C

Table 7C.1 below contains differences in 1993 annual average CPS labor force estimates when 1990 versus 1980 census-based population controls were used. The differences are defined as the 1990 estimates minus the 1980 estimates.[12]

12. The proportion of the population within any subgroup may not remain constant when 1980 vs. 1990 population weights are used. For example, the percentage of women aged 25–54 when 1980 population weights were used was 55.8 percent. When 1990 population weights were used, the percentage was 71.7 percent. Since the proportion of the population within subgroups may not remain constant when different weights are used, the difference between estimates for an aggregate group (e.g., the labor force participation rate for all women) does not have to be bound by the differences for various subgroups (e.g., the labor force participation rates for women aged 16–19, 20–24, 25–54, 55–64, and 65 years or older).

Table 7C.1 **Difference in 1993 Annual Average Labor Force Estimates Using 1990 versus 1980 Population Weights**

Demographic Group	Unemployment Rate	Employment-to-Population Ratio	Labor Force Participation Rate
Total 16+	0.10	0.08	0.16
Men 16+	0.10	0.17	0.26
Women 16+	0.10	−0.02	0.04
White men 16+	0.09	0.07	0.15
White women 16+	0.06	−0.09	−0.06
Black men 16+	0.03	0.85	1.01
Black women 16+	0.13	0.38	0.52
Teenagers (16–19)	0.03	−0.04	−0.03
20–24-year-olds	0.06	−0.13	−0.09
25–54-year-olds	0.04	−0.10	−0.07
55–64-year-olds	−0.02	−0.02	−0.03
65 years or older	−0.01	−0.07	−0.08
Men 16–19 years old	−0.04	0.08	0.08
Men 20–24 years old	0.00	0.07	0.08
Men 25–54 years old	0.04	−0.08	−0.05
Men 55–64 years old	−0.03	0.04	0.02
Men 65 years or older	0.00	−0.05	−0.05
Women 16–19 years old	0.09	−0.16	−0.14
Women 20–24 years old	0.11	−0.42	−0.38
Women 25–54 years old	0.05	−0.14	−0.12
Women 55–64 years old	0.00	−0.09	−0.09
Women 65 years or older	−0.02	−0.03	−0.04
Adult men (20+)	0.07	0.28	0.36
Adult women (20+)	0.07	0.03	0.08

Note: Difference = 1990 − 1980.

References

Aronson, Robert. 1991. *Self-employment: A labor market perspective.* Ithaca, N.Y.: ILR.

Blank, Rebecca. 1990. Are part-time jobs bad jobs? In *A future of lousy jobs?* ed. Gary Burtless. Washington, D.C.: Brookings Institution.

Bound, John, and George Johnson. 1992. Changes in the structure of wages in the 1980s: An evaluation of alternative explanations. *American Economic Review* 82, no. 3 (June): 371–92.

Bowers, Norman, and Francis Horvath. 1984. Keeping time: An analysis of errors in the measurement of unemployment duration. *Journal of Business and Economic Statistics* 2, no. 2 (April): 140–49.

Bregger, John, and Cathryn Dippo. 1993. Overhauling the Current Population Survey: Why is it necessary to change? *Monthly Labor Review* 116, no. 9 (September): 3–9.

Cohany, Sharon, Anne Polivka, and Jennifer Rothgeb. 1994. Revisions in the Current Population Survey effective January 1994. *Employment and Earnings* 41, no. 2 (February): 13–37.

Devine, Theresa. 1994a. Changes in wage-and-salary returns to skill and the recent rise in female self-employment. *American Economic Review* 84, no. 2 (May): 108–19.

———. 1994b. Characteristics of self-employed women in the United States. *Monthly Labor Review* 117, no. 3 (March): 20–34.

Dippo, Cathryn, Anne Polivka, Kathleen Creighton, Donna Kostanich, and Jennifer Rothgeb. 1994. Redesigning a questionnaire for computer-assisted data collection: The Current Population Survey experience. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics. Unpublished manuscript.

Fracasso, M. P. 1989. Categorization of responses to the open-ended labor force questions in the Current Population Survey. In *Proceedings of the Section on Survey Research Methods.* Alexandria, Va.: American Statistical Association.

Jabine, Thomas, Miron Straf, Judith Tanur, and Roger Tourangeau. 1984. *Cognitive aspects of survey methodology: Building a bridge between disciplines.* Washington, D.C.: National Academy Press.

Levy, Frank, and Richard Murnane. 1992. U.S. earnings levels and earnings inequality: A review of recent trends and proposed explanations. *Journal of Economic Literature* 30, no. 3 (September): 1333–81.

Martin, Elizabeth, and Anne Polivka. 1995. Diagnostics for redesigning survey questionnaires: Measuring work in the Current Population Survey. *Public Opinion Quarterly* 59, no. 4 (winter): 547–67.

Michael, Robert. 1985. Consequences of the rise in female labor force participation rates: Questions and probes. *Journal of Labor Economics* 3, no. 1, pt. 2 (January): S117–S146.

Murphy, Kevin, and Robert Topel. 1987. The evolution of unemployment in the United States: 1968–1985. In *NBER macroeconomics annual,* ed. Stanley Fischer. Cambridge, Mass.: MIT Press.

Palmisano, Mark. 1989. Respondents' understanding of key labor force concepts used in the CPS. In *Proceedings of the Section on Survey Research Methods.* Alexandria, Va.: American Statistical Association.

Peracchi, Franco, and Finis Welch. 1994. Trends in labor force transitions of older men and women. *Journal of Labor Economics* 12, no. 2 (April): 210–41.

Polivka, Anne. 1994. *Comparisons of labor force estimates from the parallel survey and the CPS during 1993.* CPS Overlap Analysis Team Technical Report no. 1. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics.

Polivka, Anne, and Jennifer Rothgeb. 1993. Overhauling the Current Population Survey: Redesigning the questionnaire. *Monthly Labor Review* 116, no. 9 (September): 10–28.

Rothgeb, Jennifer. 1982. Summary report of July follow-up of the unemployed. Unpublished memorandum, 20 December. U.S. Bureau of the Census, Washington, D.C.

———. 1994. *Revisions to the CPS questionnaire: Effects on data quality.* CPS Overlap Analysis Team Technical Report no. 2. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics.

Smith, James, and Michael Ward. 1985. Time-series growth in the female labor force. *Journal of Labor Economics* 3, no. 1, pt. 2 (January): S59–S89.

Thompson, Jenny. 1994. *Mode effects analysis of labor force estimates.* CPS Overlap Analysis Team Technical Report no. 3. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics.

Tiller, Richard, and Michael Welch. 1994. *Predicting the national unemployment rate that the "old" CPS would have produced.* CPS Bridge Team Technical Report no. 2. Washington, D.C.: U.S. Department of Labor, Bureau of Labor Statistics.

Tobin, James. 1972. Inflation and unemployment. *American Economic Review* 62, no. 2 (March): 1–18.

Tucker, Clyde. 1994. Visit to the Census regional office in New York. Unpublished memorandum, 6 October. U.S. Bureau of Labor Statistics, Washington, D.C.

Comment

Gary Solon

This is a nicely crafted paper, and the evidence it provides about comparability of the Current Population Survey labor force statistics before and after the survey's 1994 redesign will be useful to researchers for many years to come.

Before saying a bit about the statistical work in the paper, I first want to applaud the authors for explaining why the redesign was necessary. I suspect the first reaction of many of us academic researchers to the overhaul of the CPS is to wonder why the statistical agencies are once again disrupting the continuity of our time-series data. Polivka and Miller answer this question well. They give some compelling examples of how survey questions that may have been clear and appropriate in the 1960s had become confusing or offensive by the 1990s. The point is that our way of life has changed, and even if the statistical agencies stuck to asking the same old questions, the way respondents interpret and react to the questions would change. As a result, perfect continuity in the data series is unattainable, and we are better off if the survey instrument is periodically brought up to date. In addition, the new survey takes advantage of technological advances, especially the advent of laptop computers. It would be a shame if, for the sake of continuity, the statistical agencies forever avoided the adoption of superior survey methods just because the methods used to be technologically infeasible.

Moving on to the statistical analysis, Polivka and Miller use a simple but sensible model for Y_{it}, the labor force statistic (e.g., the unemployment rate) from survey i in period t. Their model is

$$Y_{it} = \mu_t + \lambda(i - 1) + \beta D_{it} + \varepsilon_{it}, \tag{1}$$

where $i = 1, 2$ indexes respectively the CPS and the parallel survey and $t = 1, 2, \ldots, 20$ indexes the months from October 1992 to May 1994. The μ_t parameters represent time effects, λ is the effect of the parallel survey, ε_{it} is a zero mean error term arising mainly from sampling error, and the dummy variable D_{it} equals one if survey i used the new survey design in month t and equals zero otherwise. The new survey design was introduced into the CPS in January 1994 ($t = 16$), while the parallel survey used the new design *before* January 1994 and then switched to the old design. Thus

$$D_{it} = \begin{cases} 1 & \text{for } i = 1 \text{ and } t \geq 16, \\ 1 & \text{for } i = 2 \text{ and } t < 16, \\ 0 & \text{otherwise.} \end{cases}$$

The coefficient of D_{it}, β, is the parameter of main interest. It represents the effect of the new survey design and therefore is the amount we need to subtract

Gary Solon is professor of economics at the University of Michigan.

off the CPS series after January 1994 to make it comparable with the CPS series before January 1994.

Because of the sample rotation pattern used in the CPS and the parallel survey, Polivka and Miller expect ε_{it} to be serially correlated, so they estimate equation (1) by generalized least squares (GLS). This is a good idea, but I also want to propose a simpler alternative estimator of β. Although in principle my estimator suffers from a small statistical inefficiency, its simplicity clarifies what in the data generates the evidence on the magnitude of β.

To begin with, note that in the period before January 1994, $E(Y_{1t}) = \mu_t$ and $E(Y_{2t}) = \mu_t + \beta + \lambda$. Consequently, the sample mean over this period of the discrepancy between the two surveys, $\bar{Y}_2 - \bar{Y}_1$ has expected value $E(\bar{Y}_2 - \bar{Y}_1) = \beta + \lambda$. For the unemployment rate, the sample mean discrepancy before January 1994 was $7.405 - 6.931 = 0.474$. This discrepancy was initially viewed as evidence that the new survey design would raise the unemployment rate by about half a point, but as Polivka and Miller emphasize, this discrepancy is a biased estimate of β if $\lambda \neq 0$.

The key to correcting for the bias is to note that from January 1994 on, $E(Y_{it}) = \mu_t + \beta$ and $E(Y_{2t}) = \mu_t + \lambda$, so that $E(\bar{Y}_1 - \bar{Y}_2) = \beta - \lambda$. For the unemployment rate, $\bar{Y}_1 - \bar{Y}_2$ over this later period was $6.681 - 6.993 = -0.312$. This discrepancy also is a biased estimate of β if $\lambda \neq 0$, but the bias is precisely equal in magnitude and opposite in sign to that of the other discrepancy. An obvious unbiased estimator, then, is the simple average of the two discrepancies. For the unemployment rate, the resulting estimate of β is $(0.474 - 0.312)/2 = 0.081$, quite close to the $\hat{\beta}_{GLS} = 0.079$ reported by Polivka and Miller. The small magnitude of these estimates suggests that for the overall unemployment rate, we need not lose sleep over the discontinuity caused by the new survey design.

As it happens, it is easy to show that my estimator is precisely the same as the estimator of β obtained by applying ordinary least squares (OLS) to the between-survey difference of equation (1):

$$(2) \qquad Y_{2t} - Y_{1t} = \lambda + \beta(D_{2t} - D_{1t}) + \varepsilon_{2t} - \varepsilon_{1t}.$$

Estimating equation (2) by OLS reproduces my $\hat{\beta} = 0.081$ with estimated standard error 0.044. It also produces $\hat{\lambda} = 0.393$ (with estimated standard error 0.044), quite close to Polivka and Miller's $\hat{\lambda}_{GLS} = 0.41$.

The one odd difference between my results and Polivka and Miller's is that they report a 0.076 standard error estimate for their $\hat{\beta}$, much larger than the 0.044 standard error estimate I get for my $\hat{\beta}$. At first, one might think this is because my standard error estimate is biased downward by my neglect of serial correlation in the equation (2) error term. In fact, however, the usual diagnostic statistics reveal very little serial correlation in $\varepsilon_{2t} - \varepsilon_{1t}$. My Durbin-Watson statistic is 1.89, suggesting a first-order autocorrelation of less than .1, and the higher order autocorrelations of the residuals also are small. This makes me

wonder what "**V** matrix" Polivka and Miller use in their GLS estimation and whether it is consistent with the pattern of regression residuals. If they have used an inappropriate **V** matrix, their attempt at GLS estimation may be further away from true GLS estimation than OLS estimation is. In that case, the estimator I have proposed not only is simpler than theirs but may even be more efficient.