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Payroll Employment Data: Measuring the Effects of Annual Benchmark Revisions

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Following the 2001 recession, the business press and economic analysts focused intently on the protracted weakness in the labor market, using as evidence the monthly nonfarm payroll employment data released by the U.S. Bureau of Labor Statistics (BLS).[1] Many commentators perceived the labor market during 2002–04 to be markedly weaker than it was during the recovery following the recession in 1990–91.[2] Such comparisons can be premature and potentially misleading, however. Payroll employment measures observed in real time are estimates based on a survey of business establishments. These initial estimates can differ substantially from payroll employment data that are revised to incorporate information from less timely but more complete sources. For example, payroll employment data released in 1991 differ notably from currently published data for that period. Likewise, the most recently published payroll data for 2005 have the potential to be substantially revised in the future.

Much of the existing research and commentary on the real-time accuracy of the payroll employment data series involves comparisons to employment measures from the BLS Household Survey.[3] Analysts often focus on the relative signal of labor market conditions from each of these measures around business cycle peaks and troughs. This article leaves a comparison of the real-time attributes of the two employment series to another debate. This investigation relates solely to the evolution of the payroll employment time series through data revision. The article examines whether these revisions contain information that can be exploited to anticipate future revisions. Such information could prove useful for further research aimed at modeling better real-time estimates of employment conditions.

The article begins with a general description of the different processes of data revision for the aggregate nonfarm payroll employment series. These processes include (1) the monthly survey-based revisions of data for the two reference months immediately prior to the current release month and (2) the more extensive annual

benchmark revisions that adjust the payroll survey estimates to match explicit universe counts of employment. Next, we examine how the sequence of data revisions modifies the estimates of payroll employment from their initial release. The figures illustrate the evolution of payroll employment estimates and display the magnitude and direction of each revision from the initial payroll estimate for a particular month to its currently published value. The discussion then explains the decomposition of the cumulative revision into the contributions from the monthly survey-based revisions and the annual benchmark revisions. The figures show that the largest portion of enduring change for the payroll employment estimates occurs in the benchmark revisions. Finally, we use an alternative graphing setup to isolate the effects of benchmark revisions since 1990. An extensive appendix provides the details of the benchmark revision process, highlights what the BLS reports as identifiable sources of error that underlie benchmark revisions, and presents a comprehensive table of benchmark revisions over the last four decades.[4]

The payroll employment series is widely established as a key indicator in discussions of labor market conditions and as a signal of aggregate economic conditions.

Building upon our graphical analysis, we investigate empirically whether the history of payroll employment benchmark revisions, conditional on past unemployment data and the previously published payroll employment series, helps explain the variability of payroll employment in a benchmark release. Specifically, we use a simple Granger causality test that poses the following question: If we account for the information set available in real time—namely, the lags from the payroll series just prior to a benchmark revision, including unemployment lags—can the history of data revisions, that is, the change in a measured observation from its prior value resulting from a benchmark release, help explain the variation in the new benchmark series? If the answer is yes, the result lends support for further research aimed more narrowly at modeling better real-time estimates of the underlying condition of the labor market.

The empirical results indicate the rejection of the null hypothesis that past revisions have no information for predicting the new benchmark payroll employment series. In this investigation, the test provides reduced-form evidence of a statistical relationship between past changes in the payroll employment series due to benchmarks and the new payroll employment series at a benchmark. It is a necessary condition for the revision series to have informational (and potentially predictive) content for the benchmark revisions of payroll employment, setting the stage for further statistical investigation.

Background

On June 3, 2005, the BLS released to the public its first estimate for the level of nonfarm payroll employment in May 2005, which stood at about 133.3 million. The release indicated that, on net, 78,000 jobs were created in that month. This first estimate reflects information based on a sample of over 400,000 firms in the BLS Establishment Survey. In addition to the first payroll estimate for May, per its usual practice the BLS released data revisions for the two months immediately prior—in this case, March and April. These revisions incorporate the accumulation of additional information from the monthly survey of establishments. Although the first survey revision for April nonfarm payroll employment showed no change from its previous month-to-month estimate, the second (and final) survey revision for March showed that 24,000 fewer jobs were created in that month than previously estimated.

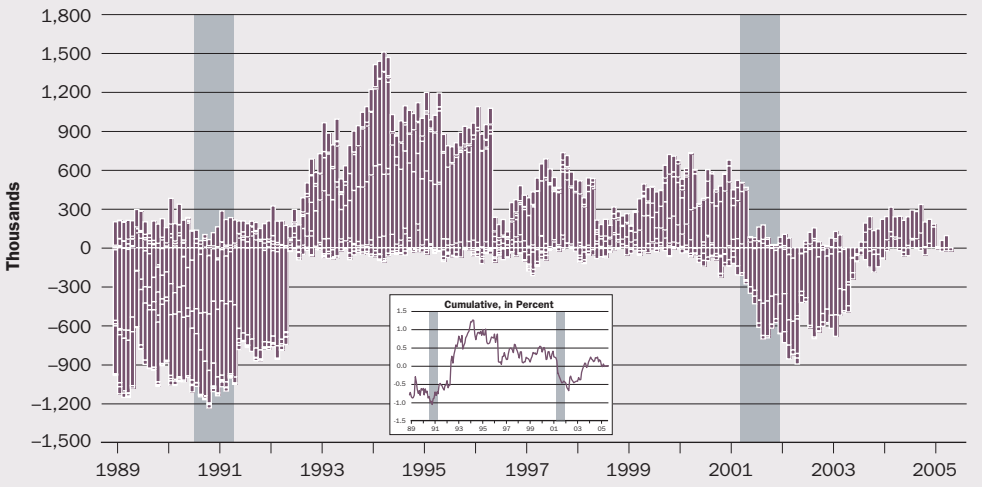
In addition to releasing or reporting monthly survey-based revisions, once per year the BLS introduces comprehensive revisions to payroll employment data, adjusting the monthly payroll estimates to universe counts of employment derived from unemployment insurance statistics. These *benchmark* revisions change numerous months of employment data and may considerably alter the observed time-series path of payroll employment over recent history. Specifically, the benchmark aligns the payroll survey employment level to the most complete count of employment in March of the previous year. The revision adjusts the not seasonally adjusted time series for the twelve months prior to the March benchmark date to link up to the previously benchmarked data. The revision also adjusts the survey estimates forward from the March benchmark date to match the new benchmark employment level, although these data are not explicitly benchmarked until the next benchmark release.[5]

The payroll employment series is widely established as a key indicator in discussions of labor market conditions and as a signal of aggregate economic conditions. The most recent payroll estimate adds to the information set that business analysts, economists, commercial forecasters, and policymakers use as the basis for extrapolations. In addition, the most recent estimate is timely, new information with implications for financial market movements and other indicators of real activity not yet released.[6]

Although the payroll employment data have these desirable characteristics, some critics suggest that the data have observable weaknesses arising from the benchmark revision process. Kitchen (2003) has claimed that the payroll employment data observed in real time are subject to potentially significant bias, thereby making the series flawed as a real-time indicator of business conditions and leading to potentially significant benchmark revisions.[7] For example, the June 1993 release of the March 1992 benchmark revision changed the entire complexion of the labor market. Using the previously available payroll data, the employment conditions were viewed as weak

1. This BLS monthly publication is *The Employment Situation*.
2. Krugman (2004) argues that the labor market was extremely weak during the recovery following the 2001 recession. Melloan (2003) provides an alternative perspective on the labor market conditions during the recovery. Groshen and Potter (2003), Schweitzer (2003), and Schreft and Singh (2003) investigate potential explanations for the observed weakness in payroll during the recovery from the 2001 recession.
3. Juhn and Potter (1999) and Schweitzer and Ransom (1999) discuss the relative merits and shortcomings of establishment-based payroll employment and household-based unemployment statistics. Bernanke (2003) discusses the two data sources along with possible explanations for the perceived weak recovery in employment following the 2003 recession. Krueger (2003) discusses statistical properties of the labor market data and suggests that such timely series are inherently noisy. Leonhardt (2004) describes the varying opinions among economic analysts about how they interpret the key labor market data releases.
4. The tabular data cover the last four decades because this period corresponds with the scope of the real-time payroll employment data set compiled by the Federal Reserve Bank of Philadelphia.
5. The BLS may make exceptions to these general procedures. See the appendix for a comprehensive account of benchmarking methodology, which details the historical application of the revisions (including revised seasonal adjustment factors) to previously published data.
6. Also noteworthy, the National Bureau of Economic Research (NBER) uses the nonfarm payroll employment series in its estimation of business cycle peaks and troughs (recession dating).
7. Kitchen presents empirical results in which available real-time household employment data can help predict current versions of payroll employment data. The empirical results demonstrate a general relationship between establishment-based payroll employment series and the household employment series. The results bear some relationship with the empirical results discussed herein. It is notable that Kitchen uses changes in the data series, without numerous lagged observations.

Figure 1
Revisions to Nonfarm Payrolls: Stacked Change from First Level Estimate



Note: The gray vertical bars indicate recessions.

Source: Federal Reserve Bank of Philadelphia Real-Time Data Set; U.S. Bureau of Labor Statistics

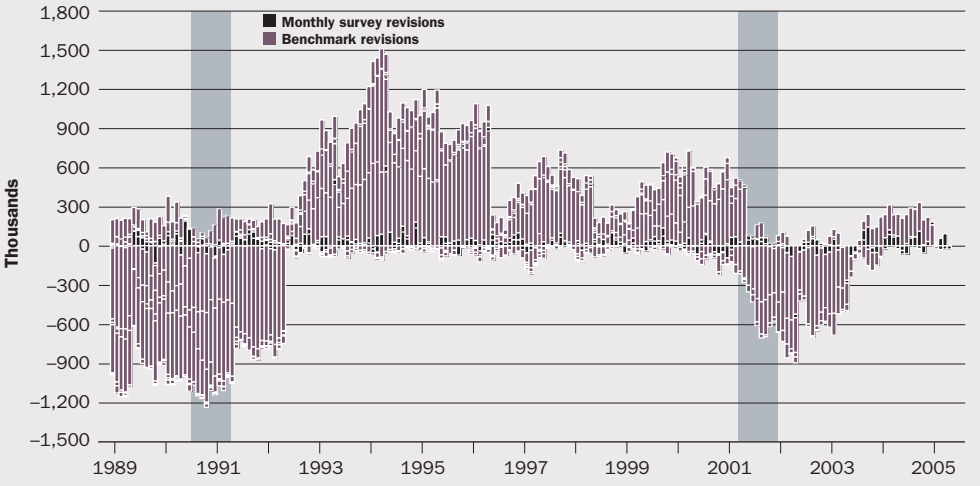
during a "jobless recovery," whereas the employment conditions looked substantially better using the newly released data associated with the benchmark.

The shortcomings in the payroll data noted by Kitchen motivate us to investigate whether there may be exploitable information contained in the revisions themselves that could potentially be used to obtain better real-time estimates of payroll employment. What we display and discuss in this article illustrates the magnitude of payroll employment benchmark revisions and their persistence in affecting the estimated data series. Beyond their obvious contribution to a more accurate measurement of employment, data revisions may contain further information about employment conditions if the past history of employment data revisions helps explain the next benchmark revision.

Comparing Revisions—Monthly Survey Versus Annual Benchmark

This section describes the process the BLS uses to revise and benchmark the nonfarm payroll employment data. Throughout this article, assume that the most recent payroll employment series—that is, the June 2005 vintage with observations ending in May—reflects the best available estimate of the level of payroll employment for each month in the data series. Note that the most recent benchmark revision (March 2004) was released in February 2005.[8] The current (June 2005 vintage) payroll employment series is the relevant endpoint for the revision process. The difference between this endpoint and the initial estimates reflects the incorporation of additional payroll information, through the revision process, accumulated by the BLS since the release of the first payroll estimate for a particular month. Specifically, we take the difference between the first estimated level of nonfarm payroll employment and the current "best estimate" for each month from January 1989 to May 2005. Figure 1 illustrates how the current estimates differ from the first estimates for each data month. The sequence of revisions subsequent to the first estimate for each month is "stacked" to

Figure 2
Revisions to Nonfarm Payrolls: Stacked Change from First Level Estimate, Benchmarks versus Monthly Survey



Note: The gray vertical bars indicate recessions.

Source: Federal Reserve Bank of Philadelphia Real-Time Data Set; U.S. Bureau of Labor Statistics

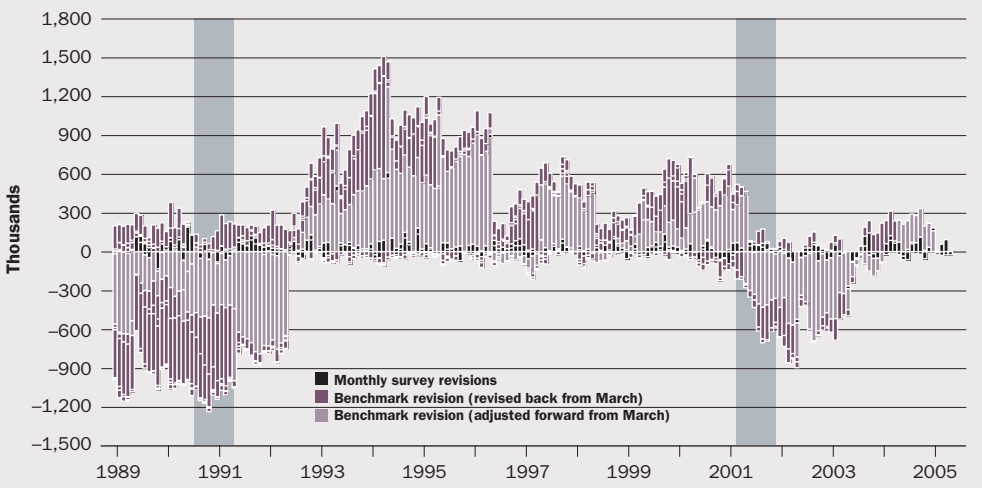
provide a complete composition of the cumulative revision. What the chart shows most clearly is how the information in the current estimate series is an accumulation of the information that is added over time through the revision process.

Separately, Figure 1 displays a visually compelling pattern that associates the revision direction with the state of the economy. That is, during business cycle downturns, the real-time payroll employment series overestimates the actual level of employment; coming out of recession into recovery periods, the real-time payroll employment series underestimates the employment level. Explanations for this estimation error suggest that the BLS has difficulty measuring net new jobs from firm births and firm deaths (closures) during business cycle transitions.[9] This source of revision provides an economically meaningful interpretation of the business cycle correlation. Yet, in the explanations that accompany the benchmark releases, the BLS emphasizes economic sources for the benchmark data revisions in many cases and stresses mainly improvements in data collection procedures in several others. As a result, the degree to which the measurement error arises from business cycle phenomena remains uncertain.

Figure 2 disentangles the cumulative data revision of each initial monthly estimate into the survey-based monthly revisions (black bars) and the benchmark revisions (purple bars). Figure 3 further decomposes the benchmark revisions to capture the effect of the benchmark revision process. The dark purple bars reflect the backward

8. Throughout the 1990s, the BLS released the March benchmarks in June of the following year with the May employment data. Beginning in 2004, the BLS has put in place new processes that accelerate the compilation of the revisions so that the most recent March benchmark is released in the following February with the January employment data.
9. The BLS has historically recognized the potential of bias in its payroll estimates associated with firm births and deaths. To address the issue, the BLS has implemented evolving processes of adjusting the survey-based payroll estimates to account for this bias. For a detailed discussion of historical BLS procedures to account for net firm births, see the appendix.

Figure 3
Revisions to Nonfarm Payrolls: Stacked Change from First Level Estimate, Benchmark Composition



Note: The gray vertical bars indicate recessions.

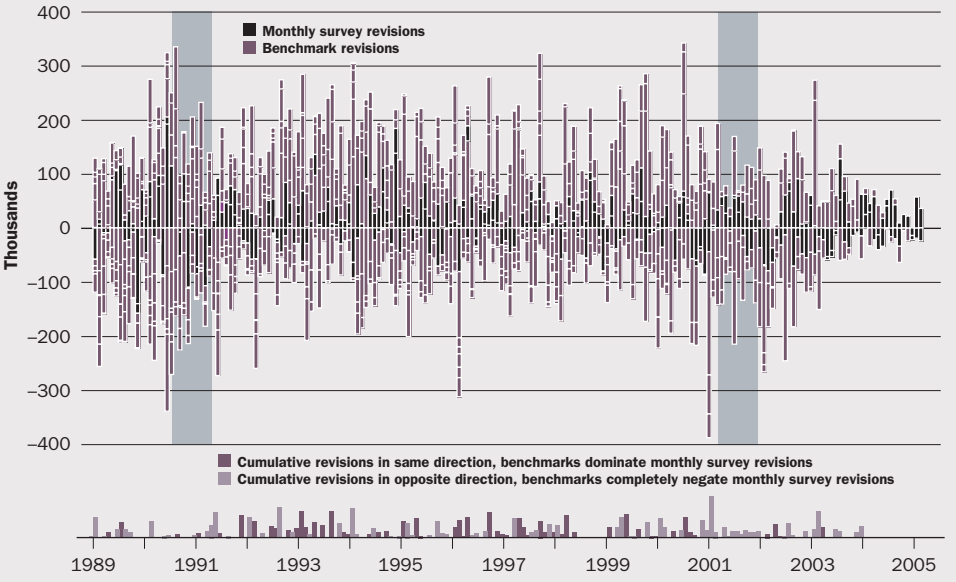
Source: Federal Reserve Bank of Philadelphia Real-Time Data Set; U.S. Bureau of Labor Statistics

adjustment from the March benchmark date, that is, the revision from sample-based estimates to benchmarked data. The light purple bars show the forward adjustment of the sample-based estimates, which are linked to the benchmarked data, illustrating that the benchmarks can have permanent effects on the payroll estimates even when the monthly observations are adjusted to match up with the benchmark level. From Figures 2 and 3, it appears that the information from the benchmarks dominates the information from the monthly survey-based revisions if what we are ultimately interested in is the most refined estimate of the payroll employment level.

To some degree, this observation seems unsurprising because the benchmark revisions are by design level-based revisions and the monthly survey-based revisions are adjustments to the change over one month. In fairness, Figure 4 displays the effect of revisions on the first estimates of month-to-month changes in payroll employment. The black bars (two stacked at each month) reflect the changes in the month-to-month estimates that result from the monthly survey-based revisions, and the purple bars represent the changes arising from benchmark revisions. Notice that, for any particular month, the initial month-to-month change may undergo numerous offsetting revisions. In this formulation, the first estimates of month-to-month changes appear affected notably by both monthly survey-based revisions and annual benchmark revisions.

To show which type of revision has the greater net effect, we provide a simple plot at the bottom of Figure 4. Here, a bar is given for each month in which the cumulative benchmark revision (the sum of purple bars at one month) dominates the cumulative survey-based revision (the sum of black bars at one month). A dark purple bar is plotted for months in which the cumulative revisions for both survey and benchmark are in the same direction. A light purple bar is plotted for months in which the cumulative revisions are in opposite directions and the cumulative benchmark revision completely negates the cumulative survey-based revision. The height of the bars shows the relative dominance of the benchmark revisions over time. The high

Figure 4
Revisions to Nonfarm Payrolls: Stacked Change from First Month-over-Month Estimate, Benchmarks versus Monthly Survey



Note: The gray vertical bars indicate recessions. In the smaller graph at the bottom, the height of the bars reflects the relative dominance of the benchmarks.

Source: Federal Reserve Bank of Philadelphia Real-Time Data Set; U.S. Bureau of Labor Statistics

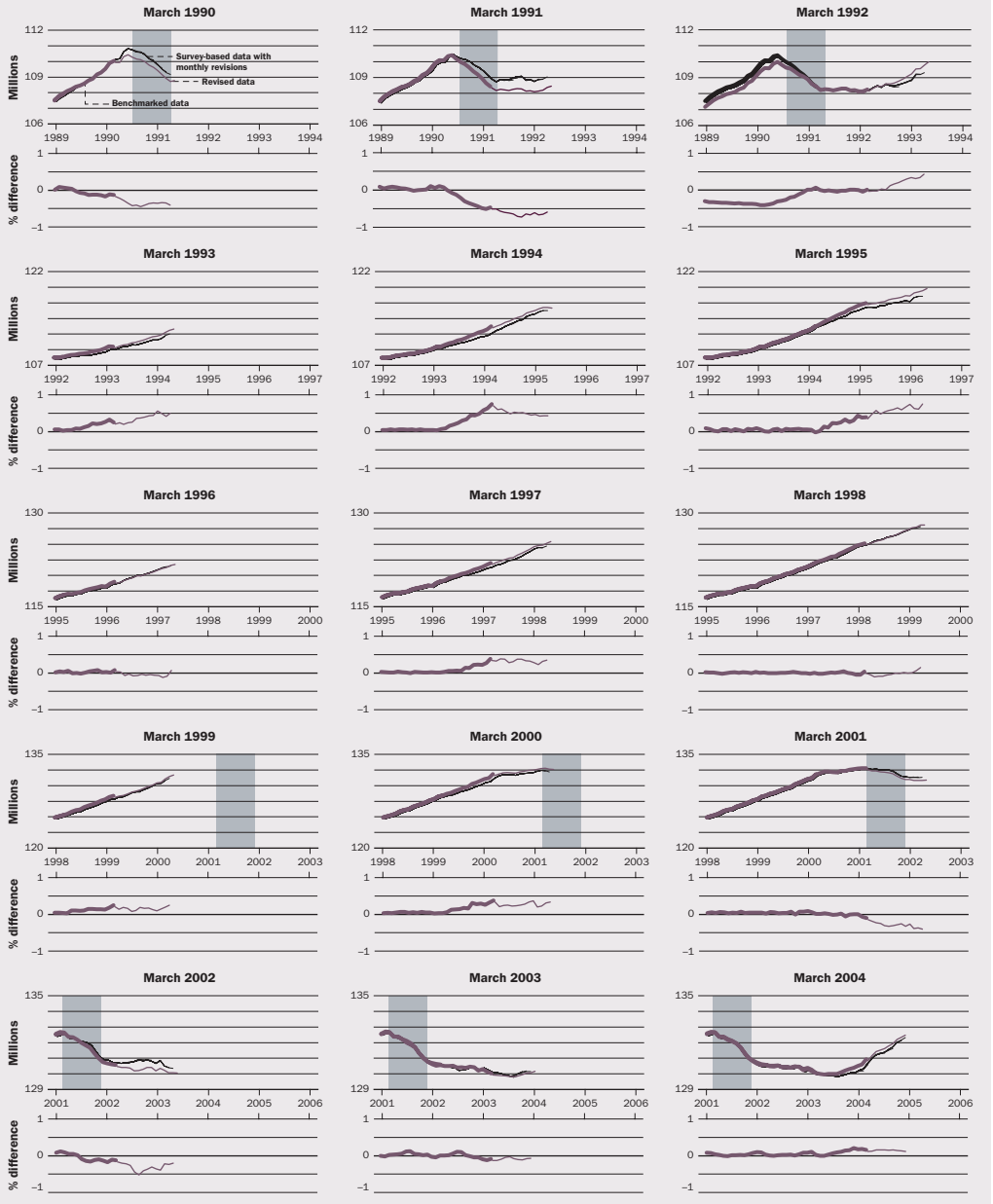
incidence of plotted bars demonstrates that the benchmark revisions have relatively larger effects than the monthly survey-based revisions even if what we are ultimately interested in is the best estimate of the month-to-month changes. The large number of light purple bars highlights that the benchmark revisions oftentimes completely negate the effect from the monthly survey-based revisions. Nonetheless, the monthly survey-based revisions may still be informative in statistical applications.

These figures can help illustrate which of the two revision sources produce the largest portion of enduring change for the payroll employment estimates. Yet the visual aspects of the revisions are limited to examining the cumulative change from the first estimates to the current best estimates. It is uncertain from these graphs which particular benchmarks (benchmark date) had the largest effect on the data series. The following discussion concentrates on the isolated effects of key benchmark revisions since March 1990, highlighting the evolving time-series path of payroll employment over the two most recent business cycles.

The Changing Face of Payroll Employment

How did the release of benchmark revisions change the characterization of labor market conditions over the last two business cycles? Figure 5 examines the real-time evolution of the revisions to uncover how policymakers and business analysts may have perceived the condition of payroll employment upon the release of a sequence of benchmarks. Two layers of graphs are shown for each benchmark revision from March 1990 to March 2004. In each top graph, the black line with small offshoots represents the survey-based releases and monthly revisions prior to the benchmark

Figure 5
The Changing Face of Payroll Employment: Isolated Benchmark Revisions from 1990 to 2004



Note: The gray vertical bars indicate recessions.

Source: Federal Reserve Bank of Philadelphia Real-Time Data Set; U.S. Bureau of Labor Statistics

revision. The thick purple line represents benchmarked data, and the thin purple line represents survey-based data adjusted forward from the benchmark level. Note that the scale is fixed across each top layer of three charts to provide a fixed frame for the revision evolution. The bottom-layer graphs indicate the percentage change reflected in the revision, ranging from 1 percent to negative 1 percent.

The upper left-hand corner displays the effect of the March 1990 benchmark, which moved the estimated level of payroll employment downward from the initial survey-based estimates. Still, the revision did not alter the trajectory of the employment decline throughout the recession. In contrast, the March 1991 benchmark substantially steepened the downward trajectory of payroll employment during the recession, showing that over 500,000 more jobs were lost (from peak to trough) than previously estimated.

Updated BLS methods should improve the accuracy of survey estimates and benchmark data, thereby reducing the size of revisions in future benchmarks.

The following year's benchmark was far-reaching and notable even though the number of jobs in the benchmark month (March 1992) did not change substantially (–59,000). This benchmark revised downward considerably the prerecession peak employment level, tempering the severity of the recession in terms of jobs lost. Separately, the BLS incorporated updated bias adjustment factors to the survey-based data post March 1992, which, in this case, led to an upward shift in the trajectory of the payroll employment series for 1992 and early 1993.[10] The backward benchmarking and forward adjustment of the data were enough to propel the level of payroll employment above the prerecession peak.

Having isolated the March 1991 and 1992 benchmark revisions, we gain a much clearer picture of their respective impacts on the time-series path of payroll employment during the 1990–91 recession and subsequent recovery. The sequence of revisions changed a sluggish measured employment market, in which the level of employment had dropped to more than 2 million jobs below the prior peak, to a healthy measured employment market that had surpassed its prior peak. Yet deeper investigation reveals the primary source of these revisions was an administrative change in the reporting of benchmark source data.[11] It is noteworthy that the direction of these revisions would still have been downward after excluding this one-off revision source.[12] Nonetheless, the 1991–92 revisions raise the point that a sequence of one-off revisions could obscure other underlying meanings for the revisions that we are interested in exploiting.

Continuing chronologically in Figure 5, the benchmarks for March 1993 through March 1995 display upward revisions during a business cycle upturn. As late as the March 2000 benchmark, the revisions indicated an upward revision to payroll employment during a period of unprecedented economic expansion. Given that March 2000 was the record peak level for the Nasdaq stock market value and that the economy appeared at that time to be roaring ahead, it is not surprising that the sequence of benchmark releases was revising payroll employment estimates upward.

With hindsight, we now see that in March 2001 a recession had begun. The benchmark revisions in March 2001 and March 2002 reduced the estimates of employment during the recession to indicate an employment contraction that was worse than previously estimated. A further small downward revision in the March 2003 benchmark indicated more protracted weakness in payroll employment. In February 2005, the March 2004 benchmark revised upward the level of payroll

10. Bias adjustment factors were used to adjust the survey-based data according to estimates of net firm births not captured by the survey. For a detailed discussion of the BLS's use of bias adjustment factors, see the appendix.
11. See the appendix for a more detailed discussion of these and other large historical revisions.
12. Excluding this one-off benchmark source data revision, the BLS inferred an estimation error of –37,000 for March 1991.

employment by a magnitude large enough to have the January 2005 employment level surpass the previous peak employment level of February 2001.

While the revisions display a consistent pattern over the past two cycles, we observe that the magnitude of the revisions over the most recent business cycle is much less than for the revisions in the early 1990s. It should be noted that the BLS has implemented many methodological improvements over the last decade in an effort to reduce the amount of measurement error in payroll employment. These improvements include sampling design changes, better benchmark source data, and an enhanced model for estimating net business births/deaths to improve the accuracy of timely survey-based releases.[13]

Any serial correlation in the changes in the payroll series due to benchmark revision suggests that past revisions may have exploitable information for anticipating future revisions.

These updated BLS methods should improve the accuracy of survey estimates and benchmark data, thereby reducing the size of revisions in future benchmarks. Thus, it appears unlikely that the next benchmark revision will alter perceptions of labor market conditions as substantially as those between March 1992 and March 1995. Nonetheless, the entire span of revisions since 1990 displays what may be a predictable element in the sequence of benchmark revisions, in which past revisions appear related to current revisions. Any serial correlation in the changes in the payroll series due to benchmark revision suggests that past revisions may have exploitable information for anticipating future revisions. For example, a sophisticated time-series model could use such information to predict the size and direction of future benchmark revisions. The following section investigates the time-series properties of historical benchmark revisions and provides empirical evidence of our findings.

Are Revision Correlations Useful Information?

Benchmark revisions followed by subsequent benchmark revisions in the same direction suggest that persistence in the revision process may exist. The time series of benchmark revisions (the difference between survey and benchmark levels) for March 1977 to March 2004 displays a positive, serial correlation of about 0.4.[14] The correlation suggests that knowing past benchmark revisions may help forecast subsequent benchmark revisions. In this section, we investigate a necessary (but not sufficient) condition for whether it is possible to exploit the information contained in the revision process. As mentioned earlier, the test boils down to a basic question: If we have the entire history of previous benchmark revision differences—that is, the past observations of how payroll employment changed after benchmarks—can that information help explain the variation in the next payroll employment benchmark release?[15]

The following reduced-form test investigates the information content of benchmark revisions in a standard linear regression model. First, we want to explain the variability and behavior of the logarithmic level of the payroll employment series at benchmark releases for the years 1990 to 2005. As explanatory variables, we use two employment measures: the unemployment data as they are currently available and the log levels of the payroll employment series that was available in the month prior to the benchmark release.[16] The explanatory series consist only of lagged observations so that they contain information for the period just prior to the release of the benchmark along with twelve additional time-series lags.

We create a set of data series from the history of benchmark revisions. Each revision series measures the difference between the log level of the benchmark release and the log level of the previous payroll employment series—log differences between

the new benchmark estimate for a given month and the previous estimate of payroll employment for that month. The vast majority of observations in the payroll employment history do not change, so these observations for the revision series equal zero.

We limit our attention to revisions lagged at least three periods and no more than twenty-six periods.[17] We overlook the first two revision lags because the history of these lags will also include the survey revision differences (that is, there will be no zeros in the nonbenchmark months).

We formulate the revision data in the following way:

$$Rvdiff_{k,\, t = Benchdate} = YB_{t-k} - YP_{t-k} \text{ for } k = 3,\ldots 26,$$
$$Rvdiff_{k,\, t \neq Benchdate} = 0 \text{ for all } k > 3,$$

where *YB* denotes (the logarithm of) the newly released observations for payroll employment following the benchmark release, *YP* refers to (the logarithm of) the payroll employment historical series available the month prior to the benchmark release, t refers to the month of the release, and k refers to the number of months prior to the most recent payroll observation in the given benchmark release. *Benchdate* is the date of the benchmark release that produces the revision observations, including all releases from 1965 to 1989 initially and adding the subsequent benchmark revision when the data sample adds another year of data. The *Rvdiff* series (three through twenty-six) has nonzero observations at each benchmark release date (*Benchdate*) and has zero observations at all other dates. These additional series are used as explanatory variables in the regression. The end result is a set of revision data series that start at 1965 with nonzero observations that run nearly annually through 2004. Table 1 provides an example of the data for the *Rvdiff* series from June 1986 through February 2004.

Recall that Figures 1–3 display how the current payroll employment series incorporate the information accumulated from all previous benchmark revisions. The benchmark and the previous payroll series already incorporate the information from past benchmark revisions, but revision differences and the history of differences are not explicit series. Here we test whether the history of benchmark revisions in a time

13. Research by Stamas, Kratzke, and Mueller (1993) and Kratzke, Shierholz, and Woodruff (1997) demonstrates the notable improvements made at the BLS in the creation process for payroll employment measures.
14. There are only twenty-eight annual observations. The preceding observations (1964 to 1976) include three missing observations. If we substitute the series mean for missing observations and add the earlier observations to the sample, then the correlation coefficient estimate falls to 0.27.
15. The empirical exercise does not forecast the subsequent benchmark revision and does not bear on whether the benchmark revisions are related to the state of the business cycle, that is, recession or expansion. Also, our focus on benchmark revisions does not preclude other inquiries into the information content of monthly revisions.
16. The information set that we assume is available to the econometrician is artificial because the unemployment series is not real-time, and it may contain information that would have been unavailable during the time horizon. The introduction of such information should only reduce the likelihood of finding useful information in past revisions. For most of this sample (1991 to 2003), the benchmark release is in June and the previous employment series is available in May. September 1990 was the release date for the March 1989 benchmark. In 2004 and 2005, the benchmark release is in February and the previous employment series is available in January.
17. One could employ observations further back than twenty-six periods from the most recent observation (as many as eighty is feasible). However, the number of benchmark revisions with nonzero observations beyond forty falls considerably. It is unclear how informative the additional revision observations would be in that case.

Table 1
***Rvdiff* Data Series**

	$Rvdiff_3$	$Rvdiff_4$	$Rvdiff_5$	...	$Rvdiff_{26}$
June 1986	nonzero value	nonzero value	nonzero value	...	nonzero value
July 1986	0	0	0	...	0
August 1986	0	0	0	...	0
September 1986	0	0	0	...	0
October 1986	0	0	0	...	0
November 1986	0	0	0	...	0
Dececember 1986	0	0	0	...	0
January 1987	0	0	0	...	0
February 1987	0	0	0	...	0
March 1987	0	0	0	...	0
April 1987	0	0	0	...	0
May 1987	0	0	0	...	0
June 1987	nonzero value	nonzero value	nonzero value	...	nonzero value
July 1987	0	0	0	...	0
...	...	...	...	...	...
June 1988	nonzero value	nonzero value	nonzero value	...	nonzero value
July 1988	0	0	0	...	0
...	...	...	...	...	...
June 1989	nonzero value	nonzero value	nonzero value	...	nonzero value
July 1989	0	0	0	...	0
...	...	...	...	...	...
September 1990[a]	nonzero value	nonzero value	nonzero value	...	nonzero value
October 1990	0	0	0	...	0
...	...	...	...	...	...
June 1991	nonzero value	nonzero value	nonzero value	...	nonzero value
July 1991	0	0	0	...	0
...	...	...	...	...	...
February 2004[a]	nonzero value	nonzero value	nonzero value	...	nonzero value
March 2004	0	0	0		0

[a]Throughout much of the 1980s and 1990s, the Bureau of Labor Statistics released the March benchmarks in June of the following year with the May employment data. However, the March 1989 benchmark was not released in June 1990, as typically scheduled, because of the introduction of the 1987 Standard Industrial Classification system. Beginning in 2004, the BLS accelerated the compilation of the revisions so that the most recent March benchmark is released in the following February.

series is useful information for predicting a subsequent revision conditional on the previous payroll employment series. The revisions data series act as a revision memory for the regression.

We estimate the unrestricted regression model as

$$YB_t = A + \sum_{i=1}^{13} B_i YP_{t-i} + \sum_{i=1}^{13} C_i Unemp_{t-i} + \sum_{k=m}^{n} D_j (Rvdiff_{t-1,k}) + u_t,\ t = \text{December } 1965, \cdots, T,$$

where *YB* denotes (the logarithm of) the newly released observations for payroll employment following the benchmark release, *YP* refers to (the logarithm of) the payroll employment historical series available the month prior to the benchmark release, *Unemp* is the unemployment rate, and t denotes the time period for monthly data. T represents a benchmark release date and goes from June 1990, June 1991, June 1992, . . . , February 2005 in subsequent regressions. Because *Rvdiff* is lagged one period, the most recent nonzero observation for *Rvdiff* is at the prior benchmark release date. For example, in the June 1990 regression, *Rvdiff* has nonzero values in June 1989, June 1988, . . . , back to December 1965. The error term is assumed to be normal and independently distributed such that $E[u_t \mid y_{t-s}, s > 0] = 0$, and $E[u_t u'_t \mid y_{t-s}, s > 0] = \Sigma > 0$ for all t.

We find that previous benchmark data revisions are useful for explaining the variation in subsequent payroll employment benchmark data.

Note that we examine the difference between the previous benchmarks and the available payroll series available just prior to each previous benchmark summarized in *Rvdiff*. The revision differences for lags m (3 or 15) to n (14 or 26) refer to the number of time periods from the relevant benchmark date, from 1965 to 2004. Each revision difference (m to n) has an associated coefficient that may or may not indicate that there is explanatory benefit from incorporating the revision series into the regression. Because the revision data consist only of those observations that would have been available as information, the revisions refer to changes made to data that are from a year ago. For $m = 3$, we examine results for $n = 26$ and for $n = 14$. We also looked at $m = 15$ and $n = 26$.

The empirical investigation boils down to a test of the restriction that all the D coefficients equal zero in each regression. We test the restriction in each of a sequence of regressions, one for each benchmark release year from 1990 to 2005. The regressions are estimated using White's heteroskedastic consistent estimator to obtain estimates of standard errors with desirable properties and to obtain the most robust properties for the statistical tests that the revision differences have zero coefficients in the regression.[18] When a model uses White's estimator, the test statistic for the restriction that all the D coefficients are zero is distributed χ^2, with the number of restrictions as the degrees of freedom. Table 2 displays the test statistics for each of the three experiments for the sequence of regressions from benchmark release years 1990 to 2005. In all three experiments, the test statistics indicate rejection of the null hypothesis that all the D coefficients are zero at the 1 percent confidence level. The results suggest that information in the revision history of the series helps explain the variation of the log of the benchmark payroll employment series in addition to the other explanatory series. Clearly, this inference is conditional on the specification and is meant only as a first-pass inquiry.

Conclusion

This article highlights the historical revisions of the payroll employment data, tracking changes from their initial estimates to their currently published values. The graphs illustrate that the largest portion of persistent change for the payroll employment estimates occurs in the annual benchmark revisions. Separately, the graphs

18. The heteroskedastic consistent estimates prevent large outlier observations from overly influencing the estimate of the standard errors.

Table 2
χ^2 Test Statistics for the Exclusion Restrictions

	Exclude lagged revision differences from regressions		
Benchmark release year	**3 to 14 χ^2 (12)**	**15 to 26 χ^2 (12)**	**3 to 26 χ^2 (24)**
1990	49.066	135.3327	742.5031
1991	50.399	89.2809	646.8475
1992	65.9894	100.6567	328.7082
1993	32.2401	135.0213	902.1978
1994	27.6492	143.4584	575.7394
1995	27.2651	127.4477	445.303
1996	22.4055[a]	118.8529	432.066
1997	34.6385	134.4690	546.8219
1998	27.1533	124.6361	563.967
1999	32.7596	130.4223	359.8006
2000	28.7943	122.4294	356.9102
2001	29.0786	124.1033	361.4091
2002	35.3124	125.0424	326.7758
2003	28.1622	73.7484	155.4384
2004	35.547	117.8825	256.4458
2005	27.1997	109.0009	278.159
1% critical value	23.34	24.74	39.36

[a]Not significant at the 1 percent confidence level. All other statistics are significant at the 1 percent confidence level.

Note: In χ^2 (N), the degrees of freedom (N) refer to the number of restrictions imposed on the regression in this application.

demonstrate strong linkages between the payroll data benchmark revisions and the state of the business cycle. However, our empirical investigation does not identify the business cycle association of benchmark revisions. As such, the analysis contributes little toward settling the debate on whether payroll employment revision data convey information that is meaningfully related to the business cycle.

Our empirical analysis tests whether past benchmark revisions help explain current benchmark employment data series conditional on past unemployment data and the previous payroll employment series. We find that previous benchmark data revisions are useful for explaining the variation in subsequent payroll employment benchmark data, and this finding satisfies a necessary condition for whether the history of past employment data revisions is informative about future benchmark revisions. Further research may incorporate this information along with other employment measures for modeling better real-time estimates of employment conditions.

Appendix
Benchmark Revisions: Past, Present, and Future

What's in a Benchmark Revision?[1]

Each year the BLS completes an annual revision of national estimates of payroll employment from its monthly survey of establishments.[2] These extensive *benchmark* revisions are necessary to correct sampling and nonsampling errors that have accumulated during the year. In the revision process, the BLS uses source data that reflect comprehensive universe counts of employment that are distinctly separate from the sample-based employment estimates. The revised data replace the sample-based level estimate of employment for March of the previous year, and as such, serve as an established benchmark for the employment level in that month.[3] The difference between the benchmark level and the sample-based level in March is then spread out linearly over the preceding twelve months.[4] This wedge-back technique assumes a constant accumulation of errors throughout the year, and it establishes a link to the previous March benchmark level.[5] Going forward in time from the new benchmark level, the BLS adjusts the previously published employment level estimates by observing the employment trend in sample-based estimates and then applying it to the new benchmark level.[6]

Benchmark revisions for total nonfarm payroll employment have averaged just 0.3 percent (in absolute terms) over the last four decades. From a statistical standpoint, the magnitude of measurement error relative to the size of total payroll employment is small. But several revisions were made since the mid-1960s that were considerably larger, including a high positive of 1.6 percent in March 1973 to a high negative of 0.6 percent in March 1991. Judging from commentary in BLS *Employment and Earnings* releases over this period, one may infer that the normal (or acceptable) range of revision is from negative 0.5 percent to positive 0.5 percent for total nonfarm payroll employment.[7] Several

1. The following information has been accumulated from monthly BLS *Employment and Earnings* publications; see Tucker (1965–66), Spinks (1967), Utter (1968–70, 1974, 1980), Armknecht (1971), Testerman (1972), Shipp (1973), Goings (1975), Beall (1976–77), Buso and Bennett (1978), Both (1979), Utter and Farrell (1981), Farrell (1982–85), Thomas (1986, 1991), Cronkhite (1987–89), Getz (1990, 1992, 1995–97), Kreisler (1993), Roosma (1994), Strifas (1998, 2003), McConnell (1999), Getz and Logothetti (2000), Mueller (2001), Duffin (2002), Lejarde (2004), and Kim (2005). Also see BLS (1977).
2. Annual revisions were not conducted as typically scheduled for March 1972 (because of data processing difficulties related to the expansion of unemployment insurance coverage) or March 1975 and March 1976 (because of problems associated with the introduction of the 1972 Standard Industrial Classification system).
3. Not seasonally adjusted data are used to establish the March benchmark level. At the time of the benchmark revision, the BLS applies updated seasonal factors to the newly benchmarked data to create revised seasonally adjusted series. Revisions to seasonally adjusted data typically go back in time five years.
4. In some instances, the benchmark/sample difference may be extended over more than one year of data prior to the benchmark month. These instances include times in which more than one year has transpired since the previous benchmark or if there is a significant change in benchmark source data. In the latter case, estimation errors must be spread over more history because earlier benchmarks based on previous source data are no longer considered accurate counts of universe employment.
5. For some subaggregate series, the BLS may elect to replace the monthly sample-based estimates completely with monthly benchmark source data if these benchmark data are perceived to reflect more accurately the employment trend over the year.
6. Updated net birth/death model estimates (historically, these were termed *bias adjustment factors*) and revised seasonal factors are also applied. In the past, summaries of the latest unemployment insurance data have also occasionally been used. A new sample composition may also affect these projected employment levels. Together or separately, these factors may notably alter the previous sample-based trend going forward from the newly established benchmark.
7. The range of revisions at the major industry division levels is much greater than for total nonfarm employment, in large part because of the effect from industry classification changes. Also, smaller industries in terms of employment tend to have larger benchmark revisions.

Appendix (continued)
Benchmark Revisions: Past, Present, and Future

identifiable sources of error can explain why employment estimates differ from their respective benchmarks. These include sampling error, nonsampling error related to the business cycle, and other nonsampling error that is noneconomic in nature. The BLS has made many procedural changes and methodological improvements over the last forty years in an effort to reduce the magnitude of revisions associated with such errors.[8] Each of these sources of error and associated BLS changes are explored in more detail below. We also provide a comprehensive table of each benchmark since March 1964 that includes the magnitude and direction of each benchmark revision, in level and percentage terms, as well as any notable comments related to the source of the revisions.

Sampling Error

Sampling error occurs any time a sample is used to make inferences about a universe. As the total universe of nonfarm payroll employment has grown by more than 70 million over the last forty years, the BLS monthly sample of establishments has increased in size from 140,000 in 1965 to 400,000 presently.[9] Over this period, the sample size has covered anywhere from 30 to 40 percent of total universe nonfarm payroll employment. This coverage implies a very small sampling error at the aggregate employment level. Still, size alone does not ensure against sample error or bias. Beginning in 1995, the BLS began extensive research into known risks of sample bias related to its long-running reliance on a quota-based sample. The findings of this research showed that the establishments in the sample, on average, were considerably older than the universe of establishments as a whole. This apparent age-of-firm bias was attributable to a lack of structured sample rotation in the survey design. Consequently, the BLS began to phase in a probability-based sample with the March 1999 benchmark revision that was completed with the March 2002 revision. The new design is intended to ensure a more proper representation of the universe of nonfarm business establishments through random selection techniques.

Nonsampling Errors, Economic-Related

Net firm births. A primary source of nonsampling error stems from the BLS's difficulty in estimating employment generated by new business formations because of the time lag between the creation of new firms and their availability for sampling. To address this issue, in the late 1960s the BLS began applying bias adjustment factors to employment estimates to raise sampled employment levels to include business births. The BLS estimated bias adjustment factors using as input measures the differences between benchmark and sample-based estimates for employment for the previous three years.[10] The bias adjustment factors were estimated at the industry level, allowing for the variation in net firm births across sectors.[11]

In hindsight, the approach had a notable shortcoming: It overestimated business births as the economic cycle changed from an upturn to a downturn. Research done in the early 1980s indicated that the total estimation error had a strong correlation with current employment growth or decline. Consequently, with the 1983 benchmark revision the BLS introduced an improved model that also incorporated data on employment growth over the most recent quarter. Still, a string of large upward benchmark revisions in the mid-1990s prompted a renewed effort to further refine the bias adjustment procedures. With the first phase-in of the sample redesign for the March 1999 benchmark, the BLS began to implement a new net firm birth/death model to replace its existing procedure of bias adjustment.[12] The net birth/death model is conceptually and empirically distinct from the previous bias adjustment procedure. Rather than estimating the total bias required to achieve an estimation error of zero, the new model estimates only the residual net birth/death employment not measurable by the sample.[13] As such, the new net firm birth/death model does not attempt to correct for other nonsampling error or other biases that are intrinsic to the sample design.

Nonsampling Errors, Non-economic-related

Benchmark source data. An infrequent but sometimes significant source of nonsampling, noneconomic error pertains to the benchmark

source data themselves. While these data do reflect the employment universe, they are still subject to error related to coverage, response, processing, and sometimes BLS methodology.[14] Over time, the discovery of such errors and the general quality improvement of benchmark source data have likely served to limit the magnitude of benchmark revisions. That said, the implementation of quality improvements has on occasion produced significant one-off benchmark revisions.

Historically, benchmark source data have been based primarily on unemployment insurance (UI) reports filed by all covered employers with state employment security agencies. In the late 1960s, these data comprised approximately three-fourths of the employment universe. Other sources of data, primarily for coverage of small firms, nonprofits, and government, supplemented the UI reports to generate a "complete" count of employment.[15] Given that these "other" data made up a nontrivial portion of the total universe, changes in their quality or source could have a significant impact on a benchmark revision.[16] For the March 1973 benchmark, these "other" source data were largely replaced by

8. The BLS has also revised and improved its seasonal adjustment procedures over time. These adjustments have affected revisions to seasonally adjusted employment levels.
9. In 1965, the BLS discussed its sample size in terms of "reports" received. Currently, the BLS refers to its sample size in terms of "business establishments" or "individual worksites." As such, the number of reports received in 1965 may have differed somewhat from the number of establishments in the sample.
10. Although the primary function of the bias adjustment factors was to account for employment resulting from new business formations, the factors also adjusted for sampling bias and other types of nonsampling error because the primary input to the modeling procedure was total estimation error. Other types of nonsampling error included a business death bias resulting from difficulty in collecting timely reports from firms as they go out of business and in determining whether nonreporting firms are out of business.
11. For construction, bias adjustment factors were derived from current measures of construction activity, such as building permits and housing starts.
12. The sample redesign itself was expected to reduce errors related to business births and deaths. The rotating sample, a more accurate reflection of sectoral employment firm representation, is updated on a quarterly basis, helping to keep the sample more reflective of the establishment universe by adding new firm births and deleting business deaths.
13. BLS research indicated that while both business births and deaths may be individually significant in size, their net contribution to total employment is relatively small and stable. The updated BLS model therefore aims to estimate only this residual component of employment. First, the BLS imputes business births based on observed business deaths, capturing the simple assumption that the flow of dying businesses is generally replaced by the flow of new businesses. The model then estimates the residual component not accounted for by this imputation based on the actual residual net of business births and deaths over the previous five years. Despite the conceptual and empirical sole focus on net business births and deaths, the model still faces difficulty in producing reliable estimates at economic turning points because of its reliance on historical patterns.
14. In addition to benchmark source data, changes in industry classification among establishments, termed "noneconomic code changes," are a major source of revision at the major industry division levels. However, in general the effect on total nonfarm employment is minimal because these revisions cancel out.
15. Since the mid-1960s, these sources have at some point included *County Business Patterns*, published by the U.S. Census Bureau (tabulation of employment covered under Social Security laws); the Governments Division of the U.S. Census Bureau (state and local governments); the Civil Service Commission (federal civilian employment); the Office of Personnel Management (complete counts of federal workers); the Interstate Commerce Commission, Railroad Retirement Board (interstate railroads); the American Hospital Association (private nonprofit hospitals); the U.S. Office of Education and the National Catholic Welfare Conference/United States Catholic Conference (private schools, colleges, and universities); the U.S. Census Bureau and National Council of Churches (religious organizations); and state agency surveys (religious organizations and employees of church-sponsored schools).
16. For example, for the 1965 benchmark the BLS introduced more complete data on religious and charitable institutions, which contributed mightily to the total revision.

Appendix Table

Summary of Benchmark Revisions, 1964–2004

Benchmark date	BLS *Employment and Earnings* release date	Benchmark level for total nonfarm payrolls, NSA (thousands)	Sample-based estimate, NSA (thousands)	Level difference (thousands)	Level difference (percent)[a]	Comments
March 1964	December 1965	56,777	56,783	–6	0.0	
March 1965	September 1966	59,069	58,784	285	0.5	Revision largely reflected improvements in the quality of benchmark source data for religious organizations, hospital employment, and agricultural services
March 1966	September 1967	62,333	62,243	90	0.1	
March 1967	June 1968	64,817	64,843	–26	0.0	
March 1968	July 1969	66,475	66,713	–238	–0.4	Benchmark adjustment reflected downward revision of state and local government payrolls due to introduction of 1967 Census of Governments' data
March 1969	June 1970	69,022	68,894	128	0.2	Revision due mainly to underestimation of new net business births in manufacturing and service industries
March 1970	September 1971	70,448	70,460	–12	0.0	
March 1971	October 1972	69,666	69,782	–116	–0.2	Modest downward revision due to sample-based errors among construction industries
March 1972	na	na	na	na	na	No benchmark revision for this year due to reporting accuracy and delinquency problems related to expansion of unemployment insurance (UI) coverage
March 1973	December 1974	75,434	74,255	1,179	1.6	Large revision primarily due to longer time span between annual benchmarks and expansion in coverage of UI data for small firms, nonprofit organizations, and other groups of employees
March 1974	October 1975	77,442	77,362	80	0.1	Revision reflected changes in industrial classification of establishments and correction of erroneous classifications, especially manufacturing, in preparation for revised 1972 SIC system
March 1975	na	na	na	na	na	No benchmark revision for this year due to problems converting to 1972 SIC system
March 1976	na	na	na	na	na	No benchmark revision for this year due to problems converting to 1972 SIC system
March 1977	October 1978	80,493	80,547	–54	–0.1	Conversion to 1972 SIC system resulted in removing roughly 60,000 employees from services industry that were previously included in total nonfarm employment count
March 1978	October 1979	84,455	83,897	558	0.7	Revision was widespread among major industries and due mainly to sample-based errors in estimating net business births; revision also included expansion of UI coverage
March 1979	July 1980	88,654	88,207	447	0.5	Upward adjustment largely due to introduction of improved benchmark source data for state and local governments
March 1980	July 1981	90,253	90,316	–63	–0.1	
March 1981	June 1982	90,371	90,720	–349	–0.4	Overestimation of business births in the sample-based estimate led to a downward benchmark revision to total nonfarm payroll employment for March 1981
March 1982	June 1983	89,566	89,679	–113	–0.1	Revision concentrated mainly in retail trade component; benchmark revision related to overestimated growth of new firms in this industry
March 1983	June 1984	88,208	88,172	36	0.0	

March 1984	June 1985	92,587	92,234	353	0.4	Upward revision reflected changes in bias adjustment factors that capture new firm births; previous benchmark understated employment growth in industries such as retail trade
March 1985	June 1986	96,042	96,045	–3	0.0	
March 1986	June 1987	98,150	98,617	–467	–0.5	Downward revisions were broad-based among all major industries
March 1987	June 1988	100,427	100,462	–35	0.0	
March 1988	June 1989	103,835	104,161	–326	–0.3	Revision mainly reflected sample-based overestimation primarily among manufacturing industries
March 1989	September 1990	107,026	107,073	–47	0.0	
March 1990	June 1991	107,114	107,343	–229	–0.2	Revision primarily due to continued overestimation of manufacturing, mining, and construction employment
March 1991	June 1992	107,507	108,147	–640	–0.6	Outsized downward revision resulted from administrative changes in reporting benchmark unemployment insurance data; reporting changes essentially corrected previous reporting inaccuracies that had overstated level of payrolls
March 1992	June 1993	107,300	107,359	–59	–0.1	Included one-time historical adjustment to aggregate nonfarm employment series for April 1981–February 1991 due to inaccuracies in benchmark source data uncovered during the March 1991 benchmark process
March 1993	June 1994	108,935	108,672	263	0.2	Pattern of underestimating entry of new firms during economic expansions led to upward adjustment in annual benchmark
March 1994	June 1995	112,141	111,394	747	0.7	Disproportionately large part of revision was related to BLS's process of extrapolating alternative benchmark source data, for non-UI industries, with a one- to two-year lag
March 1995	June 1996	115,849	115,307	542	0.5	Although smaller than previous benchmark, March 1995 revision was again related to BLS's process of extrapolating non-UI source data
March 1996	June 1997	117,952	117,895	57	0.0	
March 1997	June 1998	120,903	120,472	431	0.4	Upward revision was partially attributable to response error found in establishment surveys from help supply services industry
March 1998	June 1999	124,050	124,006	44	0.0	
March 1999	June 2000	127,125	126,867	258	0.2	
March 2000	June 2001	130,492	130,024	468	0.4	
March 2001	June 2002	131,580	131,703	–123	–0.1	
March 2002	June 2003	129,672	129,875	–203	–0.2	
March 2003	February 2004	129,148	129,270	–122	–0.1	
March 2004	February 2005	130,019	129,816	203	0.2	
Average (and absolute average) of benchmark revisions, 1964–83				107 (222)	0.1 (0.3)	
Average (and absolute average) of benchmark revisions, 1984–2004				53 (268)	0.0 (0.2)	
Average (and absolute average) of benchmark revisions, 1964–2004				77 (247)	0.1 (0.3)	

[a]Figures rounded to the nearest tenth

Source: U.S. Bureau of Labor Statistics, *Employment and Earnings* (1965–2005)

Appendix (continued)
Benchmark Revisions: Past, Present, and Future

newly available UI data, contributing to the largest benchmark revision of the last forty years at positive 1.6 percent.[17] The Employment Security Amendments of 1970 extended unemployment insurance coverage to employees of small firms, nonprofit establishments, and other groups of employees,[18] effective January 1972. The expansion in UI coverage in 1972 increased its scope to about 97 percent of the total private nonfarm employment universe. The BLS had underestimated universe counts of employment by more than 1 million workers based on the previous benchmark source data. Unemployment insurance coverage was expanded further in January 1978 and generated another large revision, although to a smaller degree, for March 1978.[19] For this revision, the benchmark level exceeded the corresponding sample-based estimate by 0.7 percent. The discrepancy also represented errors in the estimation of new business births.

In the early 1990s the unemployment insurance data themselves came into question in the March 1991 benchmark revision. That revision, at –640,000, or 0.6 percent, was the most significant downward revision during the 1964–2004 period. The revision dramatically altered the time-series path of payroll employment during the 1990–91 recession, shifting its trajectory notably downward. After comparing monthly sample-based estimates with monthly universe employment figures since the March 1990 benchmark, the BLS found that the 640,000 decline in payroll employment reflected mainly a sharp drop in unemployment universe counts in only one month—January 1991. State agencies changed their reporting procedures for unemployment insurance claims beginning in January 1991, reducing inaccuracies and improving the quality of the source data. For example, prior to 1991, some firms merely counted paychecks as opposed to explicitly counting employees. Thus, the 1991 revision uncovered administrative inaccuracies in prior benchmark data, and the substantial benchmark revision reduced employment estimates because it was a more accurate employment measure. Subsequently, the March 1992 benchmark included a one-time adjustment to historical data back to 1981, effectively spreading out the March 1991 benchmark revision back over time, in order to compensate for the previous reporting inaccuracies brought to light by this administrative change.[20] This sequence of revisions, in particular, highlighted how changes in benchmark source data can produce dramatic effects on the time-series path of payroll employment.

The large employment revisions in the 1994 and 1995 benchmarks (0.7 and 0.5 percent, respectively) were disproportionately concentrated within a small portion of the nonfarm employment population not covered by the UI universe counts. These remaining industries account for approximately 3 percent of total nonfarm employment. Some of the benchmark source data for these industries are available only with a one- to two-year lag. To compensate for this shortcoming, the BLS extrapolates these data to current levels by applying the employment trends from the UI-covered part of these industries. For 1994 and 1995 the BLS discovered that its extrapolation process was overestimating the benchmark source data, causing uncharacteristically large upward revisions from the sample-based estimates. The BLS continues to employ this extrapolation procedure today, but it has intermittently commented on its efforts to refine its methodology.

The Recent Past and Prospects for the Future

Benchmark revisions since the 1995 benchmark have been considerably smaller in size compared to those dating back to the mid-1960s. Revisions have averaged just 0.2 percent (in absolute terms) from 1996 to 2004, a little more than half of the absolute average revision (when comparing averages at two decimal places) from the mid-1960s to mid-1990s. The most recent benchmark revision for March 2004 altered the level of payroll employment by just 203,000, or 0.2 percent of the level. While the direction of revision was consistent with the employment recovery period following the 1990–91 recession, the magnitude of the revi-

sion was far more muted. The observed decline in estimation error over the last decade likely reflects the improvements in BLS sampling, net birth/death modeling, and source data extrapolation as well as the relative stability in the scope and source of benchmark data.

It may then seem plausible that the occurrence of benchmark revisions in the likeness of the "big" revisions discussed above is truly a thing of the past. The continuation of relatively small revisions would certainly be welcome by the BLS. It would also prove useful to analysts and policymakers who depend on the real-time accuracy of employment estimates. And yet further examination of benchmark revisions still provides an opportunity to glean information from their source, timing, and direction. The persistence of benchmark revisions presents a path for refining the real-time signal from aggregate employment statistics.

17. For those industries most significantly affected by the increase in UI coverage, their March 1973 benchmark/sample-based differences were wedged back five years. Also contributing to the revision was a two-year gap since the previous benchmark rather than just one year.
18. This group includes workers at state hospitals and state colleges, commission agent drivers, agricultural processing workers, and U.S. citizens working for U.S. companies abroad.
19. UI coverage expanded to include most domestic workers, agricultural workers employed by large farms, employees of state and local governments, and, except for religious workers, the employees of small nonprofit organizations and private elementary and secondary schools.
20. See Kreisler (1993) for a detailed discussion of the application of the revision to historical data.

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