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STESEG TASK FORCE ON TIMELINESS AND BENCHMARKING

BENCHMARKING STATE LABOR FORCE ESTIMATES IN THE UNITED STATES

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BENCHMARKING STATE LABOR FORCE ESTIMATES IN THE UNITED STATES

Introduction

In the United States, the Bureau of Labor Statistics (BLS) is the principal fact-finding agency for the Federal Government in the broad field of labor economics and statistics. The BLS collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, other Federal agencies, State and local governments, business, and labor. BLS data must satisfy a number of criteria: relevance to current social and economic issues, timeliness in reflecting today's rapidly changing economic conditions, accuracy and consistently high statistical quality, and impartiality.

Among the important economic data developed by BLS, unemployment estimates for States and local areas are viewed as key indicators of local economic conditions. These estimates are produced by State employment security agencies under the Federal-State cooperative Local Area Unemployment Statistics (LAUS) program. Currently, monthly estimates of employment, unemployment, and the unemployment rate are prepared for around 7,000 areas—all States and the District of Columbia, metropolitan and small labor market areas, counties, cities of 25,000 population or more, and all cities and towns in New England regardless of population.[1] The LAUS estimates are used by a number of agencies in the United States to allocate more than $40 billion in Federal funds to States and areas for a variety of socioeconomic programs. State and local governments use the estimates for planning and budgetary purposes and as determinants of need for local services and programs. The LAUS estimates are one of the most timely subnational economic measures, as the State labor force estimates are released by BLS four and one-half weeks after the reference week and just two weeks after the national estimates.

In operating the LAUS program, the BLS is responsible for concepts and definitions, technical procedures, and review, analysis and publication of estimates. The State agencies are responsible for the production of the estimates, and the analysis and dissemination of the data to their own customers.

A key element of the Bureau’s approach to subnational labor force estimation is to ensure that these estimates are comparable to the official concepts and measures of the labor force as reflected in the Current Population Survey (CPS). The CPS is the monthly survey of households that is designed to provide reliable monthly labor force estimates for the nation. To support reliability of subnational estimates, the CPS employs a State-based sample design. The State design constraint ensures that the survey sample in a State is large enough so that there is no more an 8 percent Coefficient of Variation on the annual average level of unemployment when the unemployment rate is 6 percent. (For comparison, the national reliability standard is a 1.9 percent CV on the monthly level.)

A hierarchy of estimation methods is used to produce the 7,000 estimates covered by the LAUS program, based on the availability and quality of data from the CPS. The strongest estimating method—signal-plus-noise models for current estimation and annual average CPS benchmarks—is employed at the State level. While not reliable enough to use directly, the monthly CPS values are key to the signal-plus-noise estimation. In order to ensure comparability across States, the annual average employment and unemployment levels from the CPS are used as the benchmarks for the State LAUS estimates.

As part of a major program redesign, BLS is proposing an innovative alternative to an annual historical benchmark that will address longstanding issues related to accuracy and timeliness.

Current Modeling and Benchmarking Procedure

In 1989, time series models were implemented in 39 small States and the District of Columbia for developing labor force estimates. In 1996, the time series approach to sample survey data was also extended to large States; thus, all States and the District of Columbia employed the time series methodology. The purpose of the approach is to reduce the high variability in monthly CPS estimates due to small sample sizes.

A signal-plus-noise form of the model is used, with the monthly CPS sample estimate described as the sum of the true labor force value (signal) and error (noise). Two models—one for the employment/population ratio and one for the unemployment rate—are developed for each State. In estimating the signal, the employment/population ratio model uses the statewide monthly estimate of workers on nonfarm payrolls and intercensal population data, while the unemployment rate model uses unemployment insurance claimants who file against the CPS reference week and nonfarm payroll data. Each model has a trend, seasonal, and irregular component, as well as the regression component. An important feature of the model is the use of the Kalman filter to update regression coefficients and trend and seasonal terms when gradual structural changes occur. The signal term allows the extraction of noise from the CPS time series data, thus providing a better estimate of the true value. The error term of the model reflects unique sampling error characteristics of the CPS, outliers, and irregular movements in the underlying true series.

Because of the potential for bias in the models and to ensure comparability in the estimates across all States, each year the monthly estimates of employment and unemployment are benchmarked to the respective CPS annual averages. (Also as part of annual benchmarking, the model inputs are revised as necessary, and the models are reestimated and smoothed in an iterative process that allows each observation to benefit from all observations in the series.) The primary external impetus for benchmarking to the CPS annual averages is to address the use of the estimates in distributing Federal funds. Benchmarking to the annual average from the CPS puts each State's estimates—and the resultant distribution of federal money—on the same basis. Beyond addressing this legislative use, benchmarking to the CPS is viewed as appropriate given the role of the CPS in providing the conceptual standard for the program.

The goal assigned to the statistical benchmarking procedure is twofold: (1) to ensure that the annual average of the final benchmarked series equals the CPS annual average and (2) to preserve the monthly pattern of the model series as much as possible. In practice, the two goals are conflicting, and some changes to the monthly pattern are necessary to meet the first goal. The particular method used is the Denton method.

The Denton method combines a constraint feature (relating to goal 1) and a feature that maintains the monthly pattern of the original series (goal 2). The specific routine seeks to minimize the percent differences (squared) in the model/benchmarked series estimates from month-to-month. The method is used because of the overall modeling goal of accuracy of the month-to-month changes. The method is applied to three years in pairs of years, to minimize discontinuities within the benchmark period.

Issues with a Retrospective Benchmark to Annual Averages

An annual average CPS benchmark has been employed in the LAUS program since 1974, and the Denton method of benchmarking since 1989. The Denton method is a mechanical procedure that does not take

into account the properties of the time series models and ignores the survey error. As a result, no reliability measures are available for the benchmarked estimates.

While achieving the specific goals of ensuring comparability of estimates across States and addressing potential bias in the models, a number of methodological and analytical issues have surfaced in the current estimation/benchmark procedures. These include reintroduction of sampling error to monthly estimates, discontinuities between December benchmarked and January model estimates, impaired comparability of data over the year, and inability to address, on a timely basis, "shocks" to the model such as the September 11 terrorist attacks and the onset of the economic recession.

Reintroducing sampling error

Despite the state-based sample design of the CPS, the State samples are fairly small (averaging about 950 households in small States, and 2,200 in large States) and the resultant annual averages contain a significant degree of sampling error. On the other hand, the model does a very good job of removing error from the current CPS estimates. The noise component of the current signal-plus-noise model is a sophisticated measure of the error in the CPS related to the unique aspects of the CPS sample design, as well as outliers and variance. Thus, the current model estimate of the signal is viewed as a good estimate of the true labor force value.

- Because the variance of the model is less than the sampling variance of the annual average CPS, by using the CPS annual average employment and unemployment levels as the point benchmarks, the current method puts variability back into the monthly estimates.

The reliability criterion for the State CPS sample is an 8 percent CV on the annual average level of unemployment when the unemployment rate is 6 percent. This relates to a 90 percent confidence interval of +/- 0.8 percentage points on the annual average unemployment rate in a typical State. Each year, some number of States will experience significant benchmark revisions that are related to the random nature of sampling error. In 2002, the benchmark revision for eight States was 0.5 percentage points or more, with the maximum at 1.1 percentage points. With the exception of New Mexico and Missouri, the States with a large unemployment rate revision to the 2002 CPS annual averages did not have significant revisions in the prior two years, reflective of the random nature of the CPS variance. We continue to evaluate the CPS data for New Mexico and Missouri, to identify whether a noneconomic level shift (outlier) in the CPS sample estimate has occurred for these States, or whether the model is deteriorating. (See Table 1 for 2002 benchmarking results for all States.)

Comparison of State Unemployment Rate Benchmark Revisions in Selected States
2000, 2001, and 2002

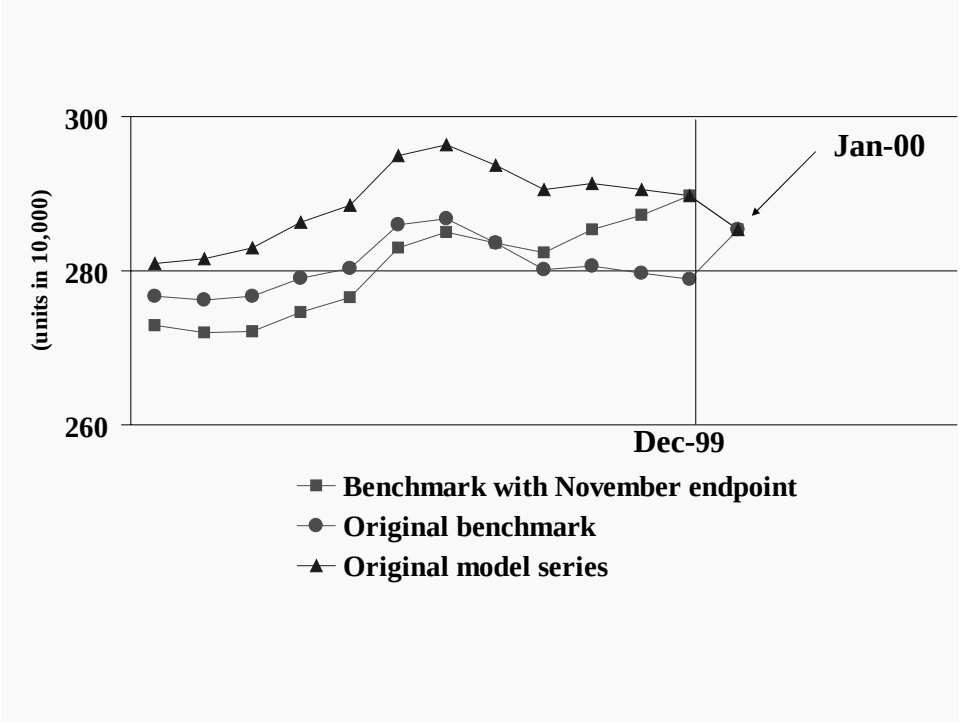
State	TUR Benchmark Revision		2002			
			TUR		Benchmark Revision	CPS Error Range on TUR*
	2000	2001	Model	CPS		
Alaska	**0.6**	0.4	6.6	7.7	**1.1**	+/-0.7
Utah	0.2	**0.5**	5.2	6.1	**0.9**	+/-0.6
North Dakota	0.2	0.4	3.3	4.0	**0.7**	+/-0.5
Kansas	0.3	**0.5**	4.5	5.1	**0.6**	+/-0.6
New Mexico	**-0.6**	**-0.9**	6.0	5.4	**-0.6**	+/-0.6
Georgia	0.2	0.1	4.6	5.1	**0.5**	+/-0.5
Massachusetts	-0.1	0.1	4.8	5.3	**0.5**	+/-0.4
Missouri	**0.7**	**0.6**	5.0	5.5	**0.5**	+/-0.5

*Error ranges are shown at the 90-percent confidence level and reflect the actual CVs.

- As long as the LAUS estimates are benchmarked to the CPS annual average, each year a small group of States will experience large noneconomic revisions in the series.

Discontinuity between December benchmarked and January model estimates: the Endpoint Effect

Under the current methodology, the previous year's December level—the endpoint of the benchmarking—reflects the adjustment to the CPS annual average and the sampling error that it contains, while the January estimate is model-based. December-January is a very seasonal period with predictable changes in employment in many States. Depending upon the size and direction of the employment benchmark revision in the State, the December-January employment change may not reflect economic reality. Rather, it will be an artifact of the benchmarking method. In the past, procedures were instituted that maintained the December-January model relationship for employment (the November endpoint), but that created serious distortion in the historical series.



- Here, too, as long as an annual average benchmarking approach is used, the December-January employment change in a small group of States will be at variance with expected seasonal movement

Impaired analysis over the year

Using the Denton method, regardless of whether the endpoint was moved to November (to preserve the December-January change) or kept to December, the ability to analyze labor force series is compromised in a number of States each year. With a November endpoint, the difference between the annual average of the model series and the CPS was forced into eleven months, causing the series to rotate around August. This distortion in the series affected analysis of the labor force data over time. Even with the December

endpoint, comparisons of modeled to benchmarked estimates can provide spurious results, depending on the size of the benchmark revision in the State.

- Each year, the ability to analyze over-the-year change in labor force estimates is compromised in a number of States.

Addressing "shocks" to the series: Sum of States versus National Estimates

In the current methodology, the State model estimates are developed independent of the national CPS. Although the monthly State CPS input data sum to the national measures, the sum of the State model estimates generally do not equal the national CPS estimates. To evaluate model performance, each month the sum of the State model estimates is compared to the national CPS estimates. Until 2001, the difference between the sum of State model estimates and the national CPS was well within sampling error of the national estimates. In 2001, significant deviations occurred in the sum of States versus national CPS measures in a number of months, specifically March, August, and October-December. Economic shocks to the national economy related to the onset of the recession and to the September 11 terrorist attacks occurred in these months. These economic shocks were not reflected in the State model estimates because the model viewed the increase in the State CPS unemployment in these periods as related to sampling error. Most evident is the post September 11 period, exacerbating the economic recession, and continuing into 2002. The inability of the current methodology to provide protection for economic shocks negatively impacts the use of the estimates in federal fund allocation and in labor market analysis.

Difference between LAUS sum-of-States and CPS national unemployment rates, 1996-2002

Month	1996	1997	1998	1999	2000	2001	2002
	Not seasonally adjusted						
January	-0.2	-0.2	-0.1	0.0	-0.1	-0.2	-0.3
February	-0.1	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2
March	-0.2	-0.3	-0.3	0.0	-0.3	-0.3	-0.3
April	-0.2	0.0	0.1	-0.1	-0.1	-0.2	-0.3
May	-0.2	-0.1	0.0	0.0	-0.2	0.0	-0.2
June	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2
July	-0.1	0.0	-0.1	-0.2	-0.1	-0.1	-0.3
August	0.0	-0.1	-0.2	-0.2	-0.2	-0.4	-0.3
September	0.0	0.0	-0.1	-0.1	0.0	-0.2	-0.1
October	-0.1	0.1	-0.1	0.0	0.0	-0.3	-0.1
November	-0.1	0.1	0.0	0.0	-0.1	-0.3	-0.3
December	-0.1	-0.1	0.0	0.0	-0.1	-0.4	-0.4
	Seasonally adjusted						
January	-0.1	-0.2	-0.2	-0.1	-0.1	-0.2	-0.1
February	-0.1	-0.3	-0.1	-0.2	-0.2	-0.2	0.0
March	-0.1	-0.2	-0.1	0.0	-0.1	-0.2	-0.1
April	-0.2	-0.2	0.0	-0.2	-0.1	-0.2	-0.4
May	-0.2	0.0	0.0	0.0	-0.2	-0.1	-0.2
June	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.4
July	-0.2	-0.1	-0.1	-0.2	-0.1	-0.1	-0.3
August	0.1	0.0	-0.1	-0.1	-0.1	-0.3	-0.2
September	0.0	0.0	0.0	-0.1	0.0	-0.3	-0.1
October	-0.1	0.0	-0.1	0.0	0.0	-0.4	-0.2
November	-0.3	0.1	0.0	-0.1	-0.1	-0.4	-0.4
December	-0.2	-0.1	-0.1	-0.1	-0.1	-0.5	-0.4

- The current methodology provides no real-time protection to the State estimates, since benchmarking is held to the end of the year.

Proposed Method: Real-time Benchmarking

As part of the redesign of the LAUS estimating system, a major change is proposed to the benchmark and the benchmarking process. Rather than continue with an annual average State benchmark applied retrospectively that reintroduces sampling error to the historical monthly estimates, BLS is proposing to

use a reliable real-time monthly national benchmark for controlling current State model estimates of employment and unemployment. In this process, benchmarking would be part of the monthly State model estimation process, rather than historical.

The model-based approach to benchmarking will produce reliability measures that take into account survey error in the monthly State estimates, as well as error in the benchmark series (including any correlations between the State and national survey errors) and estimation error in the models. The resultant series will be consistent over time, so that historical analysis of the estimates will not be distorted.

General methodological approach

Under real-time benchmarking, regional models would be developed that geographically exhaust the nation based on aggregations of States. A number of options were under consideration as the basis for the subnational groupings. These included relative size of the States, economic or demographic composition, and geographic proximity. A set of subnational groups currently in use in analyzing and publishing LAUS estimates is nine Census divisions. For the initial development of real-time benchmarking, geographic proximity as defined by these nine divisions will be employed for the regional models.

The nine regional model estimates of the signal would be developed concurrent with the release of the monthly national CPS direct survey estimates, and the sum of the nine regions would be constrained to agree with the national estimates. State model estimates would be developed where the estimates of the signal are constrained to add to the respective regional model estimates of the signal. All State model estimates within a region would be produced simultaneously in a single production run. This estimation/benchmarking approach would preclude differences between the sum of States and the national estimates, and address national shocks related to the business cycle or outliers like September 11. [2]

By using a national benchmark, the monthly error to be distributed could be large in absolute terms but small relative to the labor force measure itself. The distribution of the error to the region and, through the region, to the State will be based on each State's contribution to the monthly total error.

Annual historical benchmarking would still continue for State estimates but would be greatly altered. The updating of model inputs, model reestimation, and incorporation of updated population controls would be performed each year. However, the impact on the historical series of these benchmark activities is considered to be fairly small.

Operational issues

A number of issues must be addressed as part of making real-time benchmarking operational, including allowing for early State estimation and accommodating missing States in current estimation.

Currently, States are able to produce estimates as early as the day on which national labor force statistics are released. This is usually 6 days before the State estimates are even due to BLS and two weeks before BLS officially publishes the data. The long-standing policy of allowing early estimation and publication (currently occurring in three States) is one that BLS will attempt to maintain. Procedures are being considered that would facilitate early estimates by these States while not adversely affecting the quality of the estimates (in terms of measurement and analysis) for the other States in the estimating region. In addition, because each month's estimate undergoes revision in the next month, and because preliminary estimates generally are not used in federal program administration, early estimation should not adversely affect the use of LAUS estimates for federal allocations.

While occurrences of States missing the estimation due date or using erroneous input data have been extremely rare in the history of the program, because the proposed methodology is built on interdependence as opposed to independence, provision must be made to allow for estimation of States in a region when one or more States are missing. Procedures have yet to be developed, but, again, our concern will be to maintain the integrity of the estimates for the other States in the estimating region.

Implementation Plan

The introduction of real-time benchmarking is viewed as one of the most significant methodological changes to be introduced in the LAUS program. Implementation will be with estimates for January 2005. Discussion of redesign objectives within BLS and with State agencies has been occurring since 2002, and has influenced the ongoing design and development of procedures.

As part of implementation, a Dual Estimation Period (DEP) will be conducted so that proposed methodology and operational systems can be evaluated in a real-time environment. States will undergo technical training in October-December 2003, leading to the DEP. States will be provided the opportunity to develop and analyze monthly labor force estimates, and comment on the new methodology and operating systems. Explanatory materials for internal and external customers will be developed and user meetings held. Training in the final procedures will be conducted in the fourth quarter of 2004. Through this process of discussion, consultation, dual estimation, and training, any issue that emerges in methodology, systems, documentation, or analysis will be able to be addressed prior to formal implementation with January 2005 estimates.

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[1]Information on the technical procedures used in the Local Area Unemployment Statistics program can be obtained from the BLS Handbook of Methods, Bulletin 2490, August 1997, and from the BLS Internet at http://www.bls.gov/lau/.

[2]For a description of the proposed statistical approach, see *State-Space Modeling with Correlated Measurements with Application to Small Area estimation Under Benchmark Constraints*, D. Pfeffermann and R. Tiller; State Space and Unobserved Components Models in Honour of Professor J. Durbin, Amsterdam, 2002

Comparison of State Unemployment Rate Benchmark Revisions
2000, 2001, and 2002

State	TUR Benchmark Revision		2002			
			TUR		Benchmark	CPS Error
	2000	2001	LAUS	CPS	Revision	Range on TUR
Alaska	**0.6**	0.4	6.6	7.7	**1.1**	± 0.7
Utah	0.2	**0.5**	5.2	6.1	**0.9**	± 0.6
North Dakota	0.2	0.4	3.3	4.0	**0.7**	± 0.5
Kansas	0.3	**0.5**	4.5	5.1	**0.6**	± 0.6
New Mexico	**-0.6**	**-0.9**	6.0	5.4	**-0.6**	± 0.6
Georgia	0.2	0.1	4.6	5.1	**0.5**	± 0.5
Massachusetts	-0.1	0.1	4.8	5.3	**0.5**	± 0.4
Missouri	**0.7**	**0.6**	5.0	5.5	**0.5**	± 0.5
Arizona	0.1	0.2	5.8	6.2	0.4	± 0.7
Colorado	0.1	0.3	5.3	5.7	0.4	± 0.5
Connecticut	0.0	**0.5**	3.9	4.3	0.4	± 0.5
Idaho	0.4	0.1	5.4	5.8	0.4	± 0.6
New Jersey	0.0	-0.1	5.4	5.8	0.4	± 0.4
Rhode Island	0.3	0.3	4.7	5.1	0.4	± 0.5
South Carolina	0.2	**0.6**	5.6	6.0	0.4	± 0.6
Arkansas	0.2	**0.5**	5.1	5.4	0.3	± 0.6
California	0.0	0.1	6.4	6.7	0.3	± 0.3
Delaware	0.4	0.1	3.9	4.2	0.3	± 0.5
Iowa	0.3	0.3	3.7	4.0	0.3	± 0.5
Kentucky	0.2	**0.8**	5.3	5.6	0.3	± 0.6
Maine	0.2	**0.5**	4.1	4.4	0.3	± 0.5
Minnesota	**0.6**	0.1	4.1	4.4	0.3	± 0.5
Montana	0.0	0.1	4.3	4.6	0.3	± 0.6
New Hampshire	0.3	0.3	4.4	4.7	0.3	± 0.5
Washington	0.4	0.4	7.0	7.3	0.3	± 0.7
Wisconsin	0.2	0.3	5.2	5.5	0.3	± 0.6
Alabama	0.2	0.3	5.7	5.9	0.2	± 0.6
Florida	-0.1	**0.5**	5.3	5.5	0.2	± 0.3
Illinois	0.1	0.1	6.3	6.5	0.2	± 0.4
Mississippi	0.3	0.3	6.6	6.8	0.2	± 0.7
New York	0.0	0.2	5.9	6.1	0.2	± 0.3
North Carolina	0.1	0.4	6.5	6.7	0.2	± 0.6
Oklahoma	0.0	**0.5**	4.3	4.5	0.2	± 0.6
Pennsylvania	0.1	0.0	5.5	5.7	0.2	± 0.4
Tennessee	0.2	0.2	4.9	5.1	0.2	± 0.6
Texas	-0.1	0.2	6.1	6.3	0.2	± 0.3
Vermont	0.2	**0.5**	3.9	3.7	-0.2	± 0.4
West Virginia	0.0	-0.1	5.9	6.1	0.2	± 0.6
Wyoming	-0.1	0.2	4.0	4.2	0.2	± 0.5
Bal. of California	0.1	0.1	6.4	6.6	0.2	± 0.8
New York CC	0.0	0.3	7.7	7.9	0.2	± 0.5
Hawaii	0.0	0.0	4.3	4.2	-0.1	± 0.5
Indiana	0.1	**0.5**	5.0	5.1	0.1	± 0.5
Louisiana	**0.5**	0.4	6.0	6.1	0.1	± 0.7
Michigan	0.2	0.3	6.1	6.2	0.1	± 0.4

Nebraska	0.3	0.1	3.5	3.6	0.1	± 0.5
Nevada	0.2	0.2	5.4	5.5	0.1	± 0.5
Ohio	0.0	0.1	5.6	5.7	0.1	± 0.4
Oregon	0.1	0.4	7.4	7.5	0.1	± 0.7
South Dakota	0.0	**0.6**	3.0	3.1	0.1	± 0.4
Los Angeles	0.0	0.2	6.7	6.8	0.1	± 0.4
Bal. of New York	0.0	0.1	4.8	4.9	0.1	± 0.8
District of Columbia	0.3	**0.5**	6.4	6.4	0.0	± 0.6
Maryland	**0.5**	0.2	4.4	4.4	0.0	± 0.5
Virginia	-0.3	**0.5**	4.1	4.1	0.0	± 0.5