

Evaluating the BLS Labor Force projections to 2000

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The Bureau of Labor Statistics (BLS) prepared five labor force projections to or through 2000. Three of those projections had errors of a million or less; the most extreme errors ranged 1.5 percent above or below the actual 2000 labor force of 140.9 million. The growth rate of the labor force is also crucial to the BLS employment projection program. The error in the growth rate varied by a tenth of a percentage point above or below the actual growth rate for the periods over which the projection was made. At the same time, projections of the civilian noninstitutional population were uniformly low. Thus the labor force participation rate projections were generally too high.

Until recently BLS projections focused on years ending in five, so evaluations took place at five-year intervals. This paper is an evaluation of the BLS labor force projections to 2000 (Fullerton, 1987, 1989, 1991, 1993, 1995). Beginning in 1987 and continuing to 1995, BLS prepared five projections either to or through 2000. This article examines the difference between the projections and the labor force as estimated in the Current Population Survey (CPS) using weights from the 1990 census. The differences or errors are calculated by sex for detailed age groups of the white, black, Asian and other, and Hispanic origin population and labor force. (Earlier of these projections did not have as much age detail for Hispanics as for the other groups.) Each of the five projections to 2000 had three alternatives: high, moderate, and low. This analysis, for the most part, focuses on the middle or "moderate" growth projection in each series. Where appropriate, the accuracy of the five 2000 projections are compared with evaluations of BLS projections to 1985, 1990, and 1995 (Fullerton, 1997). Each of the projections is identified by the year from which the projection was made (1986, 1988, 1990, 1992, and 1994).

One of the challenges in evaluating projections is that the estimates are not strictly comparable to the data projected. After the 1990 census, extensive changes to the CPS were implemented in 1994. These changes included an adjustment for the undercount, as well as changes in the questions asked. The latter resulted in a greater proportion of women and older persons being counted in the labor force. It is not possible to quantify the effect of these improvements in the survey, so it is not possible to know how much they affect projection accuracy. However, it is clear that projections made before 1994 did not anticipate the effects of the

redesign and that projections made after 1994 did not immediately incorporate all the changes.

Another challenge in evaluation is the different uses made of the labor force projections. Some use the total labor force—indeed, the growth rate of the labor force—not needing any of the components. For many users, some part of the labor force is vital, for example, youth workers or older workers. Others use the projected labor force participation rates for market research or to project state populations. Another group of users focus on the distribution of the labor force by race and sex. No one measure of error or quality satisfies all these users. Further, there are two sources of error, projected population and projected labor force participation rates. It would be helpful to know how these combine to produce the errors in the labor force projections.

1. Evaluation of the aggregate 2000 projections

The following tabulation shows the projections to 2000 in millions and the numerical and percent error made in each year the projections were based:

<i>Projection for 2000</i>	<i>Labor force</i>	<i>Error</i>	
		<i>Millions</i>	<i>Percent</i>
<i>made from:</i>			
1986	138.8	-2.1	-1.5
1988	141.1	0.3	0.2
1990	142.9	2.0	1.5
1992	141.8	1.0	0.7
1994	140.0	-0.9	-0.6
<i>Actual:</i>			
2000	140.9		

The overall errors were greatest in 1986 and 1990; except for these two years, the errors were less than 1 percent. The first three projections were also evaluated for 1995. It is interesting to note that the numerical errors are less for 2000 than for 1995 with the 1988 and 1990 projections. It is possible for a projection to improve with age. The error information above indicates that short versus long time-span does not seem to be a factor improving the accuracy of labor force projections. A similar conclusion would be inferred from earlier analysis.

For some users, the absolute error or the percent error is not relevant but the error in the growth rate is. The following tabulation displays the growth rates for the civilian labor force historically with the projected annual growth rate and the actual growth rate. All three rates are in a row are measured over the same number of years. The historic rate is calculated over the same

number of years *before* the date of the projection as 2000 is *after* the date of the projection:

<i>Projection for 2000 made in:</i>	<i>Historical rate</i>	<i>Projected rate</i>	<i>Actual rate</i>	<i>Error</i>
1986	2.2	1.2	1.3	-0.1
1988	2.0	1.2	1.2	0.0
1990	1.6	1.3	1.1	0.1
1992	1.5	1.3	1.2	0.1
1994	1.2	1.1	1.2	-0.1

The error in the annual growth rate from 1988 was 0.02 percent. For four other projections, the error in the annual growth rate was either -0.1 or 0.1. For those using the projections to forecast either employment or economic growth, this level of error would be minor. For growth rates, BLS projected variously that the rate of growth would slow significantly from past rates of growth (by a full percentage point in the 1986 projection) to not much different from past rates of growth (by a tenth of a point in the 1994 projection). Except for the 1994 projection, when BLS projected a decrease in the growth rate and the labor force continued to grow at past rates, the change was in the correct direction and the error in the growth rate was less than the projected change in the growth rate.

2. Population projections

BLS labor force projections are prepared using the incidence method: age-sex-race or -Hispanic origin labor force participation rates are multiplied by comparable projections of the population prepared by the Bureau of the Census (U. S. Bureau of the Census, 1989, 1993, 1995). For all these projections, BLS adjusted the projection to provide the civilian, noninstitutional population. Although errors were made in making this adjustment, they are not considered to be sufficiently large to incorporate into this analysis. Some sense of the size of this type of error may be garnered by seeing how the errors in the adjusted population varies for the first two labor force projection. For the projection from 1994, the projected population was also adjusted for the 1990 undercount since the CPS itself was so adjusted.

Population projections have three components: births, deaths, and net immigration. Each of these may be a source of error as well as the initial population from which the projection is made. Because these projections spanned a period of less than 16 years, errors in births did not affect the size or composition of the labor force. Although it is true that there were fewer deaths than projected, most of those extended lives occurred at older ages. The source of the discrepancy must be net immigration either over the projection or as part of the estimate of the base year population. If so, then errors would be larger for Hispanics and Asian and

others. The Bureau of the Census prepares its own evaluation of their population projections (Mulder, forthcoming); this paper only looks at the population projections as they affect the size and composition of the labor force.

For the past decade, population growth has accounted for more labor force growth than has the labor force participation rate change. Thus the accuracy of population projections should be crucial to the accuracy of the labor force projections. The following tabulation shows the 2000 projections for the civilian, noninstitutional population aged 16 and with the errors associated with the total population projections:

<i>Projections for 2000 made in:</i>	<i>Total</i>	<i>Error</i>	
	<i>(in millions)</i>	<i>(in percent)</i>	
1986	204.7	-5.0	-2.4
1988	204.6	-5.1	-2.4
1990	208.0	-1.7	-0.8
1992	208.0	-1.7	-0.8
1994	208.8	-0.9	-0.4
<i>Actual</i>			
2000	209.7		

Unlike the labor force projection, all the population projections were low. Unlike the labor force projections, the population projections show steady improvement. The difference between the percent errors in the first tabulation and this one indicate that BLS made offsetting errors in labor force participation rates, reducing the errors in the aggregate labor force. The following tabulation presents hypothetical labor force projections using the projected population and the actual 2000 labor force participation rates:

<i>Projections for 2000 made in:</i>	<i>Total</i>	<i>Error</i>	<i>Difference from actual error:</i>	<i>Percent error:</i>
	<i>(in millions)</i>			
1986	136.9	-3.9	-1.8	-2.8
1988	136.8	-4.0	-4.3	-2.9
1990	139.5	-1.3	-3.4	-1.0
1992	139.2	-1.6	-2.6	-1.9
1994	140.4	-0.5	0.4	-.3

The numerical errors made in this hypothetical projection are less than for the population. Except for the projection from 1994, these projections would have a larger error than the projections that were made: the labor force would have been even smaller. The percent errors for these hypothetical labor force projections were different from that for the population projection and, except for 1994, greater.

3. Labor force participation rates

What the BLS brings to the labor force projection process is its projection of labor force participation rates. Although the population projections currently

account for most of projected labor force change, study of the errors made in projecting the labor force participation rates is important since that is the part contributed by BLS. The following tabulation shows the overall labor force participation rate for the five projections with those for men and women.

<i>Projections for 2000 made in</i>	<i>Percent</i>	<i>Error (in percentage points)</i>
1986	67.8	0.6
1988	69.0	1.8
1990	68.7	1.5
1992	68.2	1.0
1994	67.0	-.2
Actual	67.2	

Four of the five projections had the aggregate labor force participation higher than the actual. As the tabulation indicates, the aggregate labor force rate has yet to reach 68 percent, though three of the projections anticipated that this would happen by 2000. Given that 2000 was the last year in a sequence of high economic growth, it is significant that the projected labor force rates were higher than the actual. From the projection made in 1988 on, the error in the aggregate labor force participation rate decreased for each projection. However, the 1986 projection was the second most accurate.

Mean absolute percentage errors may also be calculated for the labor force participation rates. For the aggregate error, they are absolute value of the relative errors. The following tabulation provides MAPE's for various aggregations, in percent:

<i>Projections for 2000 made in:</i>	<i>1986</i>	<i>1988</i>	<i>1990</i>	<i>1992</i>	<i>1994</i>
Aggregate error	0.9	2.7	2.3	1.5	0.3
MAPE for sex	1.1	2.8	2.4	1.6	.8
MAPE for race	1.2	1.9	.9	.8	3.1
MAPE for sex and race	4.4	5.9	2.8	2.1	3.0
MAPE for sex, race, and age	14.5	9.8	5.7	6.2	5.1

Looking at errors by gender provides little additional information beyond that for aggregate error—the greatest difference from the aggregate error occurs with the projection from 1994, which had the rate for women too high and that for men too low—since there is no reward for offsetting errors. The MAPE for race indicates that the worst projection was the one from 1994. Looking at the labor force rates for the four race, Hispanic origin groups shows that the percentage point error for 1994 was zero for whites, their best projection, but that the projection from 1994 was by far the worst for blacks, Asians and others, and Hispanics. The MAPEs were not weighted by size of group. Whites

were 83 percent of the 2000 labor force, so that for weighted measures of error, the most accurate year for the overall labor force would be the most accurate year for whites. Turning to the MAPEs by race and gender, the projection from 1988 was least accurate. It was not the case that a good projection for men implied a good projection for women but certainly the converse was not true. (The correlation of men and women's errors is .33.) When the age structure is also considered, then the projection from 1986 had the greatest MAPE. The projection for this year also had the greatest numerical error. Both the population and the labor force participation projections contributed to this error in the 1986 projection, with the population too low and the participation too high.

The labor force participation rate projections from 1994 had the lowest error for whites, but the worst for other race groups. Since whites are the majority of the labor force, the 1994 projection had the lowest error in labor force participation rates. The 1986 projection had large errors in both the population and labor force participation rate projections.

There are 108 labor force participation rate projection errors to examine; the following tabulation summarizes the errors in the participation rates, in percentage points:

	<i>1986</i>	<i>1988</i>	<i>1990</i>	<i>1992</i>	<i>1994</i>
	<i>Depth</i>				
Lowest	-16.9	-9.8	-8.5	-9.0	-10.6
Lowest eighth	-5.8	-3.5	-2.6	-3.4	-4.9
Lowest quarter	-3.1	-2.1	-1.8	-1.3	-3.6
Half (median)	-0.1	0.6	0.6	0.4	-1.6
Highest quarter	3.1	3.5	2.3	1.8	0.3
Highest eight	6.6	6.1	4.3	3.4	1.7
Highest	12.4	11.1	8.3	7.6	7.1
	<i>Dispersion</i>				
Inner 50 percent	6.1	5.6	4.1	3.1	3.9
Inner 75 percent	12.3	9.7	6.9	6.8	6.6
Range	29.3	20.9	16.8	16.6	17.8

The aggregate labor force participation rates were too high in four of the five projections; the median of the errors of the age-sex-race or Hispanic origin participation rates were closer to zero than the errors of the aggregate, with the exception of the most recent projection. If the thesis is that the labor force participation rates were too high to offset population projections that were too low, then four projections of the five fit that mold. This information is also available in chart 1, which has box-and-whisker plots for the five projections.

One desirable characteristic of the projections as a sequence would be that the dispersion of the errors would be less for the more recent projections. The measures of dispersion and chart 1 indicate that this was taking place until the 1994 projection. That the

most recent projection studied for accuracy is not the most recent made seems to be a characteristic of labor force projections, this also happened with the projections to 1990 and 1995.

To examine the question, “Were some age groups harder to project than others?” turn to chart 2, which has box-and-whisker plots of the errors by age-sex-race/Hispanic origin groups. (We have six projection errors for white women aged 20 to 24, six for black women of the same age, and so on.) Although the median of the errors by projection year are near zero, except for the 1994 projection, the data by age indicate that there was significant variation in the errors by age. For the age groups 25 to 54, which exhibit the highest labor force participation rates, the median of the errors were either high or near zero, giving the source of the high aggregate labor force participation rates. For the older ages, the median of the errors were below zero. For these age groups where there is now great interest in their pattern of labor force participation, there was a consistent pattern of too low labor force participation. Labor force participation rates for older men increased from 1985 to 1990, then decreased until 1994 and have increased since then. These changes did not start at the same time for all groups of older men. Starting with the 1996 labor force projections, BLS has projected this change in trend. It was among the first the do so.

According to the box-and-whisker plots of labor force participation rates by age group, chart 2, it is clear that the age groups younger than 60 were over projected. The labor force participation rates for groups older than 60 were uniformly under projected. Some age groups were harder to project than others. The two age groups with the largest boxes were those 18 and 19 and 65 to 69. The latter group had the most extreme errors. However, the extreme errors for those 65 to 69 were high—for Asian and other men in the 1986 projection and Asian and other women in the 1988 projection.

4. Labor force

At this point, it is clear that the labor force participation rate projections were, as a group, too high. However, the aggregate labor force was fairly accurately projected. As the new labor force projections are reviewed, the reviewers know independently how fast employment was likely to grow. It appears that this review of the labor force projection resulted in an accurate aggregate labor force. In the face of low population projections, labor force participation rates were increased, resulting in an accurate projection of the labor force. The following tabulation shows MAPEs for various aggregations:

<i>Projection for 2000 made in:</i>	1986	1988	1990	1992	1994
Aggregate error	1.5	0.2	1.5	0.7	0.6
MAPE for sex	1.4	1.5	1.5	.7	.8
MAPE for race	6.2	5.9	4.7	3.9	3.4
MAPE for sex and race	6.3	5.6	5.5	4.0	4.1
MAPE for sex, race, and age	15.4	12.3	9.1	7.5	8.5

The first row repeats information from the overview. Once gender is taken into account, the 1988 projection error increases. The 1988 projection had a highly accurate projection of the level, but men’s labor force was too low and women’s too high. The other four projections did not have large offsetting errors by sex. The accuracy of the overall projection is the result of offsetting errors. The more detailed measures reveal where the errors where made. Thus, taking race and Hispanic origin into account increases the error because less of the offset is concealed. In the 1988 and 1990 projections, the projected white labor force was too large, while the black and Asian and other labor force was projected too low. The 1994 had an accurate projection of the white labor force, but that for blacks was almost a million low. For all the projections, Hispanics were under projected, by substantial amounts.

Taking race and gender into account, the error in the 1994 projection rises; this is because the accuracy of the white labor force is due to sizable offsetting errors in the men and women’s labor force. Once age, sex, race (and Hispanic origin) is taken into account, the errors increase, as offsetting errors of having some ages too high and others too low are taken into account. This shows the pattern of error decreasing from the 1986 to the 1992 projection, then increasing. The accuracy of the overall labor force was obtained through offsetting errors.

The following tabulation summarizes the 108 errors in the components of the labor force in thousands:

	1986	1988	1990	1992	1994
			<i>Depth</i>		
Lowest	-518	-543	-372	-326	-290
Lowest eighth	-244	-140	-118	-97	-100
Lowest quarter	-93	-75	-62	-43	-59
Half (median)	-16	-14	-4	-6	-13
Highest quarter	0	9	21	13	4
Highest eight	39	55	97	61	26
Highest	712	772	563	765	230
			<i>Dispersion</i>		
Inner 50 percent	94	84	84	55	64
Inner 75 percent	282	195	215	158	126
Range	1,230	1,315	935	1,091	520

The median of the individual errors are all small, but negative. The low quartiles or hinges are all negative and the high hinges are all positive—the errors are grouped around zero. The innerquartile range decreased from the 1986 projection to the 1992 one, before a slight increase for the 1994 projection. However, the range and the inner 75 percent show a decrease through 1994. The errors for the 1994 projection were systematic, but not large.

The white population and labor force is significantly larger than the black, Hispanic, or Asian and other population and labor forces. Thus, the largest numerical errors are in white groups. For the 1986 through 1992, the group with the largest over projection was white women ages 35 to 39, for the 1994 projection, white women 40 to 44 had the greatest error. For the first four projections, white men 20 to 24 were under projected the most. For the 1994 projection Hispanic men 25 to 34 were the group most under projected.

The older labor force had the greatest relative errors. The labor force for these ages is small, so a modest numerical error yields a large relative error. See chart 3 for relative errors by age group. For those age groups with high labor force participation, the relative

errors had a median of zero and the errors were closely grouped around the median. Older ages, which had too-low labor force participation rate projections for men, have negative median errors and wide dispersion around the median. Thus, the greatest errors in the labor force were at ages with modest impact on the size of the labor force. This is confirmed if a box and whisker chart of the errors in thousands is examined. If a user were particularly interested in labor force participation of older workers or the size of their labor force, this set of projections would have been relatively unhelpful.

5. Concluding thoughts

The review process for preparing labor force projections resulted in a more accurate projection of the size of the labor force. Faced with population projections that were too low, subtle adjustments in the labor force participation rate were made for the work force ages 30 to 64, resulting in somewhat high aggregate labor force participation rates. For those users of the labor force projections who needed projections of the size of the total labor force or of its growth rate, this projection would have served them well. For those users of projected labor force participation rates, the significant problem was with projections for older workers, whose rates were too low.

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Chart 1. Percentage point error in projected labor force participation rates

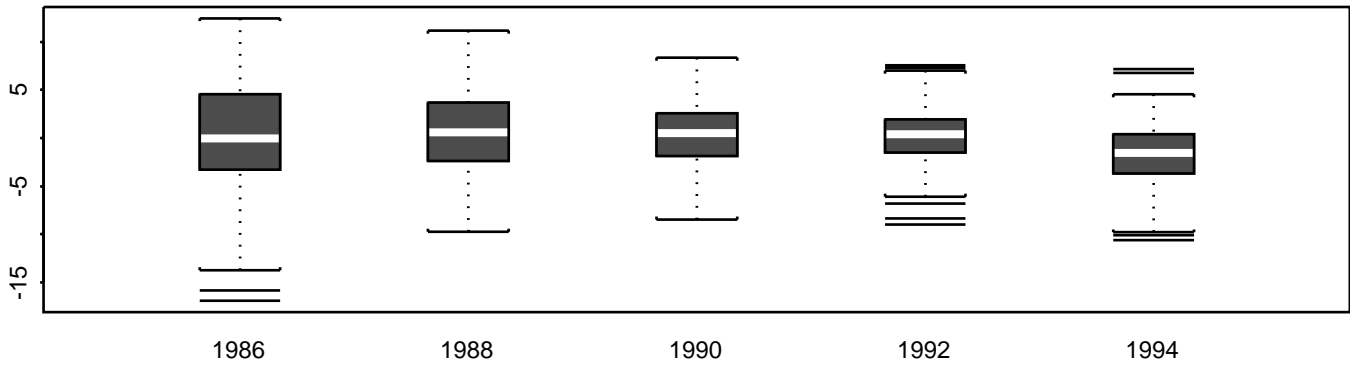


Chart 2. Percentage point error in participation rates, by age, 1986-94

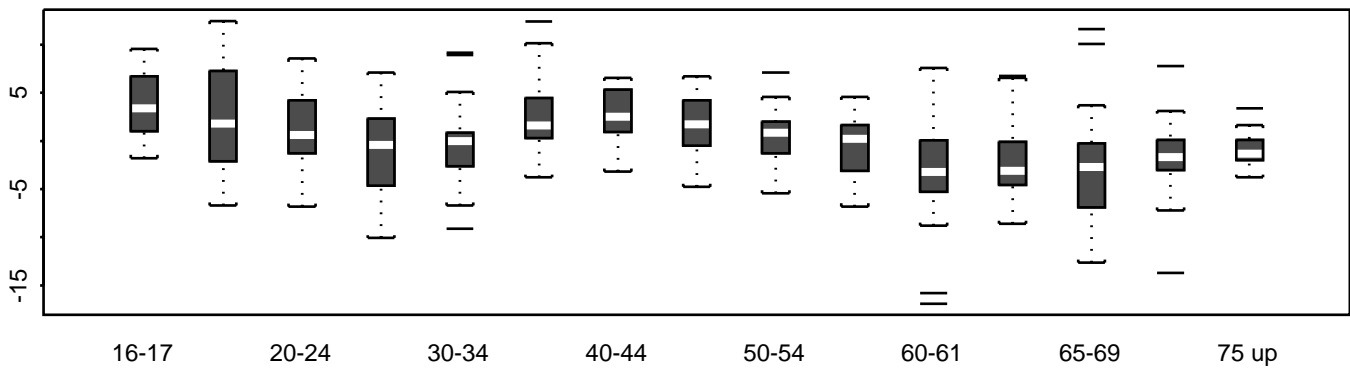


Chart 3. Error in labor force, by age, 1986-94, in percent

