

Evaluation of the BLS Labor Force Projections to 1990

Howard N Fullerton, Jr.,

Bureau of Labor Statistics

Office of Employment Projections

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Address: Washington, DC 20212-0001
Email: Fullerton_H@bls.gov
Phone: 202.606.5711
Fax: 202.606.5745

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1. INTRODUCTION

The final step in the projection process is evaluation. Such evaluations help persons making projections better understand the types of problems and errors that could occur and allows users to focus on the accuracy of projections for a specific group in the labor force or on overall accuracy. Because the labor force projections are used in a variety of ways, several criteria are used to evaluate the projections.

This paper examines the errors in the labor force projections to 1990 and their sources. It examines projected levels and the rates of labor force participation errors within specific age groups for men and women; and for white and black and other. Where appropriate, the accuracy of the 1990 labor force projections is compared with the 1975, 1980, and 1985 labor force projections.

The Bureau of Labor Statistics assesses its labor force projections -- evaluations of the projections to 1975, 1980, and 1985 have been published. See Swerdloff (1969), Ryscavage (1979), and Fullerton 1982 and 1988). The evaluations of projections for 1980 concluded that the BLS projections of the labor force had been too low, with the level of the male labor force being projected to be too high and that of women too low; in fact so low that the overall level of the projected labor force was too low. By 1985, the projections, though generally low, also included some cases where the overall projections, including those for women, were too high. Indeed, the conclusion was that BLS had improved the accuracy of its labor force projections.

Six projections of the labor force to 1990 were published over the 1973 to 1985 period. See the following *Monthly Labor Review* articles: Johnston (1973), Fullerton and Flaim (1976 and 1978), Fullerton (1983 and 1985), Fullerton and Tschetter (1983). Each of the six projections had three alternatives; for most of this analysis, the focus will be on the middle or "moderate" growth projection in each series. (See Appendix table 1.) In this analysis, we compare the projected labor force numbers for 1990 with the annual average estimates of the labor force derived from the Current Population Survey, using weights from the 1980 Census. We call such estimates "the actual." Table 1 shows the 6 projections to 1990 (in millions) and their errors:

Millions Projection for 1990 published in:	<i>Labor force</i>	<i>Error</i>	<i>Percent error</i>
1973	110.6	-14.2	11.4
1976	113.8	-10.9	8.8
1978	119.4	-5.4	4.3
1980	122.4	-2.4	1.9
1983	125.0	.2	.1
1985	122.6	-2.1	1.7
1990 labor force (actual)	124.8	---	---

The overall error became progressively smaller through the 1983 projection, when it was 0.1 percent, or fewer than a quarter of a million persons, but increased in the next projection (1985) to 1.7 percent, to near that of 1980. What were the sources of labor force error and why, with one exception, did the error fall as time passed?

A closer look at the 1990 labor force projections rounds for men and women provides a clue. For most of the rounds, labor force levels for both women and men were projected too low.

The 1983 projection of women in the labor force was too high, but in 1980, there was no difference between the actual and projected number of women in the labor force. Men had the most accurately projected labor force estimates in 1983, the year their labor force was slightly overprojected. In the 1985 projection, the error was about the same size for men and for women.

It is to be expected that the earlier projections are less accurate than the more recent ones. The table 2 displays the growth rates for the total civilian labor force historically with the projected annual rate and the actual annual rate of change. The historic rate is calculated over the same number of years *before* the date of the projection as 1990 is *after* the date of the projection. The historic rate gives a standard of comparison--a naive projection:

Table 2. Historical and projected annual growth rates, selected periods and to 1990				
Percent	<i>Historical rate</i>	<i>Projected rate</i>	<i>Actual rate</i>	<i>Error</i>
	(1)	(2)	(3)	(2) - (3)
Projection for 1985 published in:				
1973	1.75	1.34	2.02	-0.68
1976	2.00	1.30	1.92	-.62
1978	2.36	1.45	1.80	-.35
1980	2.65	1.41	1.59	-.18
1983	2.29	1.58	1.57	.02
1985	1.76	1.29	1.59	-.29

The error in the projected growth rate for the 1985 labor force projection was greater than the error in the 1980 projection. Still, the more recent projections are the more accurate. The 1983 projected labor force growth rate is the only one that exceeded the actual growth rate. This table also allows us to characterize the labor force projections: All six projections reflected a view that the labor force would grow more slowly in the future than it had in the past. This did not happen over the 1973 to 1990 period, but did hold for the remainder of the projections.

Labor force projections are prepared by BLS by developing for each specific age-sex (and in the more recent projections, race) group a projected labor force participation rate. Then, using population projections by the Bureau of the Census for the same specific age-sex group, total labor force levels are developed. Consequently, in reviewing the labor force projections, there are two possible sources of error--the population projection and the participation rate projection. Before the 1980 Census, population projections were considered to be a trivial source of error and their potential contribution to the errors in the labor force projections was ignored. However, after the 1980 Census, there was a significant upward revision in the estimated civilian noninstitutional population that resulted in a similar upward revision in the labor force estimates for the 1971-82 period. The current labor force estimates are consistent with those revisions. The labor force projections made to 1985 were low by some 3.4 million because of errors associated with estimating the population size and making population projections. For the 1970 and 1973 projections for 1985, this amounted to a third of the error. For the 1976 and later projections made to 1985, the error due to participation rate projection dropped, so the share of error attributed to population projection increased.

In this paper, the consequences of errors in the population projections will be examined first, then the effects of labor force participation rate errors. This will include an examination of the errors in the age-sex specific labor force participation rates and the resulting errors in labor force composition.

2. POPULATION ERRORS

Table 3 shows 1990 projections for the civilian, noninstitutional population aged 16 and older for men and women (in millions) and the errors associated with the total population projections.

Millions				
Projection for 1990 published in:	<i>Total</i>	<i>Men</i>	<i>Women</i>	<i>Error of total</i>
1973	179	85	94	-9.5
1976	179	84	95	-9.1
1978	180	85	95	-7.8
1980	180	85	95	-7.9
1983	180	85	95	-7.9
1985	187	89	98	-1.4
1990 population (estimated)	188	90	98	

As indicated, the error in the population projection fell over the 1973-78 period, was steady in 1980 and 1983, and then dropped sharply in 1985. The population projections were published in U.S. Bureau of the Census (1972; 1975; 1977; 1982; and 1984). To determine further the effects of the population projection error, the projected age-sex specific labor force participation rates for 1990 were multiplied by the actual 1990 civilian, noninstitutional population. Had the actual civilian noninstitutional population been known or projected correctly, all the projections except that made in 1983 would have been more accurate. The 1983 and 1985 projections' errors would have been trivial (less than one percent). The size of the errors because of population projection errors varied, unlike the case for the projections prepared for 1985. For the 1976 through 1980 projections, population projection errors added more than 5 million to the labor force error.

The error due to low population projections affected the male labor force projections more than the female labor force projections. This reflects the cause of the projection error: under estimation and projection of immigration. For men 25 to 34 there was an error of over a million due to population projection errors for the projections made over the 1976-80 period. With adjustments for immigration reflected in more recent projections, the error due to population projections dropped sharply for this age group and overall.

There are four elements of a population projection: the base year estimate, projections of births, of deaths, and of net immigration. Should the estimated structure or size of the population in the base year be incorrect, this will be extended through the early years of the projection. If projected net immigration is too low or too high, both the level and the age composition of the projected population would be affected. Errors in the base year estimates and projected net immigration significantly affect the labor force projections. For the period of time over which BLS makes labor force projections, the fertility and mortality assumptions have only a minor effect.

Although base year estimates and net immigration were the components of population projection error that significantly affected the labor force projections, the error was essentially the same: under estimates or under projections of immigration. More specifically, the sources of these errors were undocumented and refugee immigration. The base year estimates for projections using the 1970 census reflected under-enumeration of immigrants in the 1970 census as well as under estimation of immigration during the 1970's. The 1980 census also differed significantly from the 1970 census in coverage. Much of this, but not all, can be attributed to immigration over the period.

Until 1989, the Census Bureau did not incorporate any estimate of undocumented immigrants into their middle series population projections because they were not in their current estimates. Thus, the base year estimates were too low because of under-enumeration in the census and because undocumented immigrants were not included in the population estimates for the intervening years. Further, between 1985 and 1990, there were a major revisions of immigration law; the likely effect on the level and composition of immigration could not have been incorporated since the projections do not anticipate major changes in policy. Currently, the Census Bureau and BLS use more than one immigration scenario to reflect the effect of alternative assumptions about immigration on the size and composition of the population and labor force.

Although the population projection errors cannot be allocated between the base year errors and the specific immigration projection errors, it is possible to determine the share of overall error in the projection of the labor force due to population and the share due to participation rate error (table 4). This was done by using the projected labor force participation rates and the estimated 1990 annual average civilian noninstitutional population.

Table 4. Division of projection error between participation rate and population errors			
Millions			
Projection for 1990 published in:	Total error	Error attributed to:	
		Participation	Population
1973	-14.2	-9.6	-4.6
1976	-10.9	-5.6	-5.3
1978	-5.4	-.2	-5.2
1980	-2.4	3.0	-5.4
1983	.2	1.4	-1.3
1985	-2.1	-.9	-1.2

The errors due to the population projection dropped across the sets of projections, from a high of 4.6 million for the 1973 projection to a low of 1.2 million for the 1985 projection. Because the errors due to participation rates dropped for the first three projections, the population errors became a greater proportion of the overall error in the labor force projections in each succeeding projection. Two-thirds of the error in the 1973 projection may be attributed to the participation rate errors; by the 1985 projection, that had dropped to less than one-half of the error.

According to this analysis, the size of errors in the population projection varied over the 5 projection years. Population accounted for a small proportion of the error in the earliest projection. As participation rate error decreased in later projections, population projection error accounted for an increasing proportion of the error in the projected labor force level. By 1980, the errors in projecting labor force participation and in projecting population offset each other. The primary source of error for the population projections was underestimates of immigration, in particular, lack of any accounting for undocumented immigrants. This was anticipated by the authors of the 1978 projections who suggested that "The population projections might have to be revised to reflect a better knowledge of net migration trends, particularly with regard to the inflows of undocumented aliens," see Fullerton and Flaim.

3. MEASURES OF ERRORS

For each of the six projections of the 1990 labor force, there are 20 combinations of age-sex groups and, therefore, 20 possible errors. The errors in participation rates can be examined. One can either look at each error or calculate a statistic to summarize the error for a specific projection. Different summary statistics emphasize different problems with the projections.

Summary measures of errors. This measure is calculated using the mean of the absolute value of percent errors in the age-sex specific labor force participation rates. The percent or relative errors attach more significance to errors in groups with low participation. The MAPE's for the projected participation rates ranged from 6.8 to 11.8, with the 1973, 1978, and 1980 projections having by far the greatest values. See appendix table 2. The other three remaining projection years (1976, 1983, and 1985) had the same MAPE's, around 6.9, with the 1983 projection having the lowest error. This is consistent with the earlier finding that the growth rate projected in 1983 had the least error. It appears that the 1976 projection is more like the 1983 and 1985 projections than like the earlier ones. Using this measure, the range of error is down from that for the projections to 1985. Further, the greatest MAPE for the projection to 1990 (11.6) is much smaller than the greatest for the projections to 1985 (17.0).

Regression. Another summary measure of the errors in the labor force projection is the regression of projected labor force participation rates against actual 1990 labor force participation rates. If the projections were perfect, the actual labor force participation rate plotted against the projected rate would yield a straight line through the origin with a slope of 1. The table 5 presents estimates of the slope and intercept of these lines for each projection with a test of the hypothesis that the intercept is zero and the slope 1:

Projection for 1990 published in:	<i>Intercept</i>	<i>Slope</i>	<i>F-test</i>	<i>Probability > F</i>
1973	3.2	1.0	0.52	0.60
1976	1.2	1.0	.30	.74
1978	3.2	.9	.98	.39
1980	1.3	.9	2.31	.13
1983	1.6	1.0	1.49	.25
1985	3.7	1.0	5.29	.02

Except for the 1985 projection, the hypothesis of "perfect forecast" cannot be rejected. (Since the errors in the projections are found not to be normally distributed, the reader may ask why an F-test is used because the normal distribution is required for such a test. A short answer is that it still provides a useful indication. For a discussion of the problem and methods of handling the problems, see Scheffe', (1959). Generally, the slopes are consistent with an interpretation of the errors being widely diffused among groups--no specific groups were overprojected or underprojected. The large values for the intercept reflect the errors in the participation rates. Tests of the hypothesis that the intercept is zero are not rejected. Thus, we conclude from these tests that the projections are unbiased, but have sizable errors.

Three of the projections are displayed in charts 1 through 3. The charts display projected labor force participation rates plotted against the actual for 1990 for 20 age groups. The dashed diagonal line from corner to corner shows the "line of perfect forecast:" the line where the markers would be on if the projection were perfect: values above this line are underprojected, below it, overprojected. The solid diagonal line summarizes how well the projected values, taken together, approximate the "line of perfect forecast." For the 1973 projection, the fitted line is not parallel to the line of perfect forecast. It is pulled up by the cluster of rates projected to be 50 to 60 percent but which were in to 60 to 70 percent range. The value most over projected was for men 60 to 64. Labor force participation rates for women 25 to 34 were under projected the most. For the 1978 projection the lines are close. The observations are not as far from the line as in the 1973 projection. For this projection, there were over projections of the rates for teenagers, while the rates for women 45 to 54 and men 60 to 64 were under projected. The 1983 projection exhibits more precision--the values are even closer to the fitted line, but again the line does not coincide with the line of perfect

forecast. The charts as a group suggest that the projections improved over time; the errors being equally likely to be extremely positive or negative.

Median error. The errors in the projection of participation rates for the various age-sex groups range from 22.5 percent too low for women 35 to 44 in the projection made in 1973 to 14.4 percent too high for men 60 to 64, also in the 1973 projection (appendix table 2). For the other projections to 1990, one of the teenager groups had the greatest over projection, reflecting the drop in their participation that occurred at the end of the projection period. The most recent BLS labor force projection assumes that participation for these ages will return to their levels of the late 1980's. See Fullerton (1991).

Table 6 indicates the median error for each year a projection was made to 1990, the dispersion of the error and the extreme values of the errors:

Table 6. Summary of labor force participation projection errors						
	1973	1976	1978	1980	1983	1985
Median	-0.05	0.15	-0.80	0.45	-0.20	-0.55
MAD	6.1	3.7	4.9	4.4	3.1	2.1
Greatest	14.4	7.1	11.6	12.8	7.3	3.2
Lowest	-22.5	-13.5	-10.7	-6.9	-4.2	-6.0

If BLS is improving its projections, the median error would be closer to zero in 1985 than in 1973. This pattern does not appear, but all the median errors are less than one percentage point, suggesting a random drift with a small error. A median error near zero indicates that the projection was unbiased. That is not helpful if large positive and negative errors tended to cancel each other. The dispersion, here measured by the mean absolute deviation (MAD), also became smaller. A low measure of dispersion indicates that there were few large, offsetting errors. Another way to verify this is to look at the greatest over projection and lowest under projection. We see that these numbers did get closer together in the more recent projections. The projections made in 1983 and in 1985 had their greatest errors less than 10 percent. This contrasts with the projection made in 1973, with errors greater than twenty percentage points. By comparison, an evaluation of projections of the 1985 labor force shows a 25-percent greatest error--more than any error in the projections for 1990.

Shapiro-Wilk test. Generally, it is assumed that errors are distributed according to the normal or Gaussian law. We can test for this using the Shapiro - Wilk test. Values for the test ranged from .90 to .92 for the 1973 to 1983 projections. By these test values, the hypothesis of normality would be rejected. The 1985 projection's test value was .96, which is consistent with normally distributed errors. Departures from normality could occur because the errors were not symmetric, for example more negative than positive errors, or because the tails of the distribution were too "fat" (there were several errors with very large positive or negative values) or too "thin." The kurtosis statistics indicate that the errors are grouped more closely around the mean than a Gaussian distribution making significance tests, such as regression tests, conservative. However, it appears that the distribution of errors did become more symmetric in the more recent projections.

Age, sex, and race errors. In the first two projections to 1990, there were large errors in the participation of women 25 to 54, reflecting assumptions that the participation rates of mothers would not grow sharply. They did. The pattern of errors reflect problems in projecting the participation rates of women born in the 1940's. Thus, BLS moved from an under projection of 10 percent in the 1976 projection of participation rates of women 25 to 34 to an over projection of 4.5 percent in 1978. The over projection grew to 7.1 percentage points before dropping to an over projection of 2.6 percentage points in 1985.

The pattern of groups with greatest errors shifted from women 25 to 54 in the 1973 projection to teenagers in the 1985 projection. Given the cyclical responsiveness of the

teenage groups and the small number of these people in the labor force, it is not surprising that this is where the larger error is found. Of greater concern are the errors in participation of older workers, men ages 60 to 74 and women 65 to 69—because these errors may reflect a change in the long term trend in labor force participation for older workers. To illustrate this, the error in the participation rate for men 60 to 64 made in 1973 was 14 percentage points too high; by 1985, it was projected 5 percentage points too low. The 1973 to 1985 period was a time of rapid decreases in participation at these ages. Since 1985, participation has barely dropped. The same pattern of projecting participation too high at the beginning of the 1973-85 period and too low at the end also applies to women 60 to 64, though the percentage point error is lower.

In general, participation for men was projected higher than the actual--the overall rates were too high for five projections, with the lowest error in 1978 and the greatest in 1973. For women, the first three and the last projections of participation were too low--by 11 percentage points in the 1973 projection. The 1980 and 1983 projections had participation too high for women, as measured by their overall rate. (See appendix table 2.) This suggests that as time passed, the projections of women and men's participation were adjusted to reflect the changes in participation observed. Because the errors in participation for women were greater than those for men in all six projections, overall participation was under projected or over projected according to the pattern for women.

Starting with 1978, the labor force was projected by two race groups independently: whites and blacks and others. Because the white labor force is still the much larger component, errors in the projection of this group has a greater effect on the overall error. Overall white participation was over projected in 1978 through 1983. Participation for both white men and women was over projected in all projections, with the greatest error in 1980.

In 1978, participation of both black men and women was under projected. The errors were much greater for blacks and others than for whites. In the 1980 and 1983 projections, rates for black men were more accurately projected than for whites, men or women. However, the rates for women were projected too high. The overall rate for black men was very near their actual 1990 rate. The errors were equivalent in participation rates by sex and race for 1985. Given that the black participation rates as measured are more variable than those for whites, the relative accuracy of black labor force participation is a surprise.

Relative errors. As noted earlier, the errors in participation of older women are small. That is not surprising as their participation is low. Relatively, their participation error is larger. For example, the 1.3 percentage point error for women 70 and older is a 26.6 percent relative error. Men in the prime working years have participation well over 95 percent, their relative errors are roughly the same size as their percentage point errors; women's participation is lower, their relative errors will be larger than their percentage point errors.

The earliest characterization of 1973 being by far the least accurate and 1978 being the most accurate holds for the relative error in overall participation. Overall, participation was more accurately projected for men than for women. Men's participation was equally accurate in 1978, 1983, and in 1985, whereas women's participation was projected most accurately in 1978. There was an improvement in the projection of both women and men's rates over the last two projections.

The relative errors by race were higher for blacks and others than for whites. Black women had the highest relative error, black men the lowest.

To summarize the findings for detailed age groups, for the early years, the largest relative errors were for women 25 to 44. Starting in 1978, the relative errors for women 25 to 44 were no longer large, but were for teenagers and those 65 and older. These errors approached the size of the earlier relative errors for women 25 to 44. For women 20 to 34—principle ages of childbearing—the relative error was least for the 1985 projection. Since

1978, there has been an over projection of participation rates for women these ages. The 1976, 1983, and 1985 projections had about the same accuracy; the 1978 was worst.

Composition errors. Much of the interest in the labor force projections centers on its size and growth. To understand these, we must also consider labor force participation rates. However, there also is interest in the composition or age-sex structure of the labor force (appendix table 3). The index of dissimilarity measures how much the projected composition would have to change to be like the 1990 actual. For example, the 1980 projected composition would have to change by 3.7 percent to have the same composition as the 1990 estimates. Although the projected composition was worst in 1973; it improved with each projection, with the greatest improvement between the 1973 and 1976 projections. The errors in distribution for the 1973 projection were concentrated in men and women 25 to 44. For other projections, the error is widely distributed with small errors for any group.

4. ALTERNATIVE LABOR FORCE PROJECTIONS

For each of these projections, two alternative projections were made. This raises at least two questions: did the range from low to high span the actual, and was one of the alternatives closer to the actual than the middle reviewed in the earlier sections. For evidence, we turn to chart 1. The last four projections had a range that did indeed cover the actual 1990 level. The 1978 high alternative was closer to the actual than the middle; the low alternative was closest in 1985.

The first two projections are striking. Not only did the 1973 and 1976 projections fail to cover the actual line, but the range was much smaller. At the time the projections were made, women in the 25- to 44-age group were a small part of the labor force. Their labor force participation rate though low, was growing rapidly. Although these women were the most significant source of error for the projections, they were too small to yield a large variation in the overall labor force. BLS changed its methodology in 1978 to have variations in labor force participation for all age groups.

For any year, BLS alternatives plotted through time have a "fan" shape; they are further apart the further from the take-off-year. It would then appear that these plots of alternatives should exhibit a "funnel" shape, the closer the alternative projections got to the target year, the more certain the projections should be about the actual. Over the 1978 to 1985 period, BLS was interested in making the range of projections approximate a confidence or credible interval. By the time the 1985 labor force projection was made it was apparent that economic variables could not be used to account for the variability in the labor force that a confidence interval approach implied. The alternative labor force projections are used in the aggregate economic projections, thus there must be some economic content in the alternatives. Starting with the 1985 labor force projection, the "fan" of alternatives did not spread more widely with each successive projection. Thus, in later evaluations, we should observe some of the "funnel" shape.

5. ASSUMPTIONS

One of the questions of concern in the evaluation of projections is, "why one set has less error than another, particularly if the reason yields information which could improve future projections?" The BLS labor force projection method involves a high level of disaggregation followed by extrapolation of the labor force participation rate. The refinement of the methodology over time has included using five-year-of age data (1972 to present), use of parental status for women (1972 to 1978), and disaggregation by race (1978 to present). The extrapolation technique developed for the 1972 projection dampened the estimated growth rates for women rapidly. For the 1976-85 projections, tapering of rates was greatest toward the end of the projection period. Because the projections improved with later projections, the

question arises whether the improvements result from changes in methods or simply later data.

For the labor force projections made over the 1972-85 period, the change in participation rates was projected. These changes were applied to a "take-off" (or base) participation rate and then successive participation rates were projected. To project the changes, past changes in participation rates were estimated. It was *assumed* that participation rate changes would ultimately cease. For the 1972 projection, when the drop in fertility rates had just begun, it was assumed that the rapid growth in women's labor force participation would soon cease as fertility increased. The opposite occurred and fertility dropped to the levels prevailing in the early 1930's and remained there. If a behavioral model relating fertility and women's labor force participation had been developed and used, the expectation that fertility would rise also would have led to participation lower than that which actually occurred. For the remaining projections, it was also assumed that changes in participation would also end, but that the greatest slowdown would be towards the end of the projection period--for the 1976 projection, between 1990 and 1995, for later projections, after 1995. For the 1980 projection, it was assumed that participation rates for women aged 20 to 44 would increase at an increasing rate then increase at a decreasing rate.

The problems involved with selecting a take off point have been discussed by Ryscavage (1979) and Kok and de Neuborg (1986) and by Armstrong (1978) as the problem of estimating the current level. Especially in the short run, a projection's accuracy can be affected by the choice of a take off point. Because the 1972 projection was to be made for the years 1980, 1985, and 1990, 1970 was used as a takeoff point. This affected the accuracy of 1973 projection. The 1976 projection used the average of the last three years; later projections have used the last year in the sample period. If the rate of change is under estimated because a linear estimate is made when change is actually growing non-linearly, then every year the take off year is moved back compounds the problem. The effect of not using the most recent year is to shift the entire projection down (or up) for the entire period.

The 1973 through 1978 projections explicitly used the fertility assumptions to derive the number of women with young children. The use of the assumptions overstated the number of women with young children for the 1973 and 1976 projections and understated it slightly for the 1978 projection.

6. SUMMARY

Overall comparison. Eleven explicit tests of the 1990 labor force projections were made. Which projection was best? Table 7 lists the number of times a specific projection was best or worst.

Table 7. Number of times a projection was best or worst		
Projection	Best	Worst
1973	1	6
1976	1	...
1978	1	3
1980	1	1
1983	2	...
1985	5	1

The 1973 projection was worst 6 times. The 1985 projection ranked best on 5 tests, but was *worst* once. In considering this, there are several ways a projection can be best. For example, if errors offset, the projected level of the labor force would be nearly the actual level, yet the participation rates and the projected population would be incorrectly projected.

However, if the main use of the projected labor force was the level or the growth of the overall labor force these details would not matter.

These tests help the user evaluate the projections in terms of their own needs--for accurate level of the total, for accurate participation rate projections, or for accurate projections of the composition. Different tests of the accuracy of the participation rate projections allow the user to focus on overall accuracy or accuracy of specific groups.

Earlier evaluations. As a group, the projections to 1990 were more accurate than the projections to 1975 and 1985. (See table 8.)

Table 8. Comparison of projections to 1985 and 1990 for specific characteristics				
Projection to:	1990		1985	
<i>Errors in level (millions)</i>				
Best (year):	.2	(1983)	-0.5	(1980)
Worst (year)	-14.2	(1973)	-11.0	(1970)
<i>Error in growth rate (percent)</i>				
Best (year):	.02	(1983)	-0.07	(1978)
Worst (year)	-0.68	(1973)	-0.61	(1970)
<i>Mean Absolute Percent Error</i>				
Best (year):	6.8	(1985)	6.0	(1980)
Worst (year)	10.8	(1973)	17.0	(1970)
<i>Index of dissimilarity</i>				
Best (year):	2.6	(1985)	1.4	(1980)
Worst (year)	7.6	(1973)	7.5	(1970)

According to these summary measures, the worst projection to 1990 was worse than the worst projection to 1985, but the best projection to 1990 was often significantly more accurate than the best to 1985. When adjusted for the actual population, four projections to 1990 were more accurate. Generally, the more recent projections were more accurate, with the 1985 projection the most accurate.

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Appendix Table 1. Characteristics of the 1990 labor force, and participation rates, actual and as projected in 1973, 1976, 1978, 1980, 1983, and 1985

Labor force group	Labor force (in thousands)							Participation rate (in percent)						
	As projected in --						Actual	As projected in --						Actual
	1973	1976	1978	1980	1983	1985	1990	1973	1976	1978	1980	1983	1985	1990
Total	110,576	113,839	119,366	122,375	124,951	122,653	124,787	62.0	63.6	66.2	67.9	66.9	65.7	66.4
Men, 16 and older	66,947	65,220	65,115	65,880	67,701	67,146	68,234	79.1	77.3	76.4	77.2	76.5	75.8	76.1
16 and 17 years	1,511	1,612	1,740	1,733	1,664	1,453	1,477	45.6	50.8	54.9	54.5	51.0	44.4	43.7
18 and 19 years	2,159	2,364	2,459	2,483	2,459	2,387	2,389	63.2	71.4	74.4	74.3	73.2	70.2	67.0
20 to 24 years	6,462	6,671	6,957	7,066	7,151	7,323	7,291	81.1	82.1	85.0	86.4	84.4	86.3	84.3
25 to 34 years	19,382	18,545	18,401	18,453	19,569	19,665	19,813	95.4	94.7	93.9	94.3	93.7	94.1	94.2
35 to 44 years	17,131	16,571	16,593	16,672	17,469	17,318	17,268	95.6	94.8	94.8	95.2	95.6	94.7	94.4
45 to 54 years	10,863	10,901	10,851	11,022	11,142	11,096	11,177	92.5	90.2	89.4	90.8	91.3	90.8	90.7
55 to 59 years	4,109	3,990	3,870	3,922	3,842	3,849	4,014	86.9	81.6	77.6	78.7	78.1	78.3	79.8
60 to 64 years	3,195	2,714	2,513	2,703	2,577	2,446	2,771	69.9	57.7	52.0	55.9	52.8	50.2	55.5
65 to 69 years	1,365	1,125	932	1,019	1,019	873	1,192	34.4	26.6	21.2	23.2	23.3	20.0	26.0
70 years and older	770	727	799	807	809	736	841	11.6	10.7	11.2	11.3	10.3	9.4	10.8
Women, 16 and older	43,629	48,619	54,253	56,495	57,250	55,507	56,554	46.5	51.4	57.1	59.6	58.3	56.6	57.5
16 and 17 years	1,205	1,448	1,608	1,685	1,461	1,309	1,356	37.4	46.9	52.1	54.7	46.2	41.4	41.9
18 and 19 years	1,975	2,201	2,531	2,509	2,317	2,139	2,188	56.2	62.5	72.1	72.1	66.5	61.3	60.5
20 to 24 years	5,808	6,656	7,086	7,131	7,035	6,641	6,552	66.3	75.2	80.4	81.4	78.1	73.8	71.6
25 to 34 years	10,669	13,077	16,063	16,568	16,804	16,366	15,990	51.6	63.5	78.1	80.7	78.1	76.2	73.6
35 to 44 years	10,216	11,678	13,820	14,581	14,974	14,458	14,576	54.0	63.0	74.5	78.6	78.6	75.9	76.5
45 to 54 years	7,362	7,795	7,830	8,320	8,718	8,808	9,316	58.3	60.3	60.5	64.3	67.1	67.8	71.2
55 to 59 years	2,853	2,703	2,642	2,650	2,791	2,779	3,059	53.3	51.0	49.5	49.7	51.1	51.0	55.3
60 to 64 years	2,150	1,811	1,628	1,826	1,821	1,869	2,016	39.2	33.7	30.1	33.8	32.1	33.0	35.5
65 to 69 years	864	768	649	772	829	705	941	16.7	14.2	11.9	14.1	15.1	12.9	17.0
70 years and older	527	482	394	453	500	433	561	5.0	4.4	3.5	4.0	4.0	3.5	4.8
Whites	--	--	103,751	105,867	107,734	105,467	107,177	--	--	66.9	68.3	67.3	65.9	66.8
Men	--	--	57,185	57,800	59,201	58,524	59,298	--	--	77.4	78.1	77.4	76.5	76.9
Women	--	--	46,586	48,067	48,533	46,943	47,879	--	--	57.4	59.3	58.1	56.2	57.5
Blacks and others	--	--	15,615	16,508	17,217	17,186	17,610	--	--	62.0	65.8	64.8	64.5	63.7
Men	--	--	7,930	8,080	8,500	8,622	8,936	--	--	69.9	71.5	71.0	71.7	71.1
Women	--	--	7,683	8,428	8,717	8,564	8,674	--	--	55.6	61.1	59.7	58.6	57.6

NOTE: Dash indicates data not available.

Appendix Table 2 . Difference between the 1990 labor force participation rates and the projections made in 1973, 1976, 1978, 1980, 1983, and 1985												
Labor force group	Percentage-point difference						Absolute percentage-point error					
	1973	1976	1978	1980	1983	1985	1973	1976	1978	1980	1983	1985
Total	-4.4	-2.8	-0.2	1.5	0.5	-0.7	6.6	4.2	0.3	2.3	0.8	1.1
Men, 16 and older	3.0	1.2	.3	1.1	.4	-.3	3.9	1.6	.4	1.4	.5	.4
16 and 17 years	1.9	7.1	11.2	10.8	7.3	.7	4.3	16.2	25.6	24.7	16.7	1.6
18 and 19 years	-3.8	4.4	7.4	7.3	6.2	3.2	5.7	6.6	11.0	10.9	9.3	4.8
20 to 24 years	-3.2	-2.2	.7	2.1	.1	2.0	3.8	2.6	.8	2.5	.1	2.4
25 to 34 years	1.2	.5	-.3	.1	-.5	-.1	1.3	.5	.3	.1	.5	.1
35 to 44 years	1.2	.4	.4	.8	1.2	.3	1.3	.4	0.4	.8	1.3	.3
45 to 54 years	1.8	-.5	-1.3	.1	.6	.1	2.0	.6	1.4	.1	.7	.1
55 to 59 years	7.1	1.8	-2.2	-1.1	-1.7	-1.5	8.9	2.3	2.8	1.4	2.1	1.9
60 to 64 years	14.4	2.2	-3.5	.4	-2.7	-5.3	25.9	4.0	6.3	.7	4.9	9.5
65 to 69 years	8.4	.6	-4.8	-2.8	-2.7	-6.0	32.3	2.3	18.5	10.8	10.4	23.1
70 years and older	.8	-.1	.4	.5	-.5	-1.4	7.6	.8	3.6	4.6	4.5	13.0
Women, 16 and older	-11.0	-6.1	-.4	2.1	.8	-.9	19.1	10.6	.7	3.7	1.4	1.6
16 and 17 years	-4.5	5.0	10.2	12.8	4.3	-.5	10.7	11.9	24.3	30.5	10.3	1.2
18 and 19 years	-4.3	2.0	11.6	11.6	6.0	.8	7.1	3.3	19.2	19.2	9.9	1.3
20 to 24 years	-5.3	3.6	8.8	9.8	6.5	2.2	7.4	5.0	12.3	13.7	9.1	3.1
25 to 34 years	-22.0	-10.1	4.5	7.1	4.5	2.6	29.9	13.7	6.1	9.6	6.1	3.5
35 to 44 years	-22.5	-13.5	-2.0	2.1	2.1	-0.6	29.4	17.6	2.6	2.7	2.7	0.8
45 to 54 years	-12.9	-10.9	-10.7	-6.9	-4.1	-3.4	18.1	15.3	15.0	9.7	5.8	4.8
55 to 59 years	-2.0	-4.3	-5.8	-5.6	-4.2	-4.3	3.6	7.8	10.5	10.1	7.6	7.8
60 to 64 years	3.7	-1.8	-5.4	-1.7	-3.4	-2.5	10.4	5.1	15.2	4.8	9.6	7.0
65 to 69 years	-.3	-2.8	-5.1	-2.9	-1.9	-4.1	1.8	16.5	30.0	17.1	11.2	24.1
70 years and older	.2	-.4	-1.3	-.7	-.7	-1.2	5.2	7.5	26.6	15.7	15.1	26.1
Whites	--	--	.1	1.5	.5	-.9	--	--	.1	2.2	.7	1.3
Men	--	--	.5	1.2	.5	-.4	--	--	.7	1.6	.7	.5
Women	--	--	-.1	1.8	.6	-1.3	--	--	.2	3.1	1.0	2.3
Blacks and others	--	--	-1.7	2.1	1.1	.8	--	--	2.7	3.3	1.7	1.3
Men	--	--	-1.2	.4	-.1	.6	--	--	1.7	.6	.1	.8
Women	--	--	-2.0	3.5	2.1	1.0	--	--	3.5	6.1	3.6	1.7
Mean absolute percent error	--	--	--	--	--	--	10.8	7.0	11.6	9.5	6.9	6.8

Appendix Table 3. Distribution of the 1990 labor force and as projected in 1973, 1976, 1978, 1980, 1983, and 1985													
Labor force group	Distribution as projected in --							Percentage-point difference from 1990					
	1973	1976	1978	1980	1983	1985	1990	1973	1976	1978	1980	1983	1985
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
Men, 16 and older	60.5	57.3	54.6	53.8	54.2	54.7	54.7	5.9	2.6	-0.1	-0.8	-0.5	0.1
16 and 17 years	1.4	1.4	1.5	1.4	1.3	1.2	1.2	.2	.2	.3	.2	.1	.0
18 and 19 years	2.0	2.1	2.1	2.0	2.0	1.9	1.9	.0	.2	.1	.1	.1	.0
20 to 24 years	5.8	5.9	5.8	5.8	5.7	6.0	5.8	.0	.0	.0	-1.1	-1.1	.1
25 to 34 years	17.5	16.3	15.4	15.1	15.7	16.0	15.9	1.7	.4	-5.5	-8.8	-2.2	.2
35 to 44 years	15.5	14.6	13.9	13.6	14.0	14.1	13.8	1.7	.7	.1	-2.2	.1	.3
45 to 54 years	9.8	9.6	9.1	9.0	8.9	9.0	9.0	.9	.6	.1	.0	.0	.1
55 to 59 years	3.7	3.5	3.2	3.2	3.1	3.1	3.2	.5	.3	.0	.0	-1.1	-1.1
60 to 64 years	2.9	2.4	2.1	2.2	2.1	2.0	2.2	.7	.2	-1.1	.0	-2.2	-2.2
65 to 69 years	1.2	1.0	.8	.8	.8	.7	1.0	.3	.0	-2.2	-1.1	-1.1	-2.2
70 years and older	.7	.6	.7	.7	.6	.6	.7	.0	.0	.0	.0	.0	-1.1
Women, 16 and older	39.5	42.7	45.5	46.2	45.8	45.3	45.3	-5.9	-2.6	.1	.8	.5	-1.1
16 and 17 years	1.1	1.3	1.3	1.4	1.2	1.1	1.1	.0	.2	.3	.3	.1	.0
18 and 19 years	1.8	1.9	2.1	2.1	1.9	1.7	1.8	.0	.2	.4	.3	.1	.0
20 to 24 years	5.3	5.8	5.9	5.8	5.6	5.4	5.3	.0	.6	.7	.6	.4	.2
25 to 34 years	9.6	11.5	13.5	13.5	13.4	13.3	12.8	-3.2	-1.3	.6	.7	.6	.5
35 to 44 years	9.2	10.3	11.6	11.9	12.0	11.8	11.7	-2.4	-1.4	-1.1	.2	.3	.1
45 to 54 years	6.7	6.8	6.6	6.8	7.0	7.2	7.5	-8.8	-6.6	-9.9	-7.7	-5.5	-3.3
55 to 59 years	2.6	2.4	2.2	2.2	2.2	2.3	2.5	.1	-1.1	-2.2	-3.3	-2.2	-2.2
60 to 64 years	1.9	1.6	1.4	1.5	1.5	1.5	1.6	.3	.0	-3.3	-1.1	-2.2	-1.1
65 to 69 years	.8	.7	.5	.6	.7	.6	.8	.0	-1.1	-2.2	-1.1	-1.1	-2.2
70 years and older	.5	.4	.3	.4	.4	.4	.4	.0	.0	-1.1	-1.1	.0	-1.1
Whites	--	--	86.9	86.5	86.2	86.0	85.9	--	--	1.0	.6	.3	.1
Men	--	--	47.9	47.2	47.4	47.7	47.5	--	--	.4	-3.3	-1.1	.2
Women	--	--	39.0	39.3	38.8	38.3	38.4	--	--	.7	.9	.5	-1.1
Blacks and others	--	--	13.1	13.5	13.8	14.0	14.1	--	--	-1.0	-6.6	-3.3	-1.1
Men	--	--	6.6	6.6	6.8	7.0	7.2	--	--	-5.5	-6.6	-4.4	-1.1
Women	--	--	6.4	6.9	7.0	7.0	7.0	--	--	-5.5	-1.1	.0	.0
Dissimilarity index	--	--	--	--	--	--	--	6.4	3.6	2.6	2.5	1.8	1.5

NOTE: Dash indicates data not available or not applicable.

Chart 1. Range of projections for 1990, made 1973-85

