Accuracy of the Colorado Business Economic Outlook Forecast by Sector 1972 to 2001

By Colorado-based Business and Economic Research

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Purpose

- The purpose of this analysis is to evaluate the forecast accuracy of the Colorado Business Economic Outlook (CBEO) for the period 1972 to 2001. The forecast is prepared by the Leeds School of Business and sponsored by BBVA Compass Bank.
- The CBEO has distinguished itself by presenting forecasts for each of the Standard Industrial Classification (SIC) sectors. This analysis focuses on SIC sectors only, i.e. SIC codes changed to NAICS codes in 2002.
- Nationally, most employment or economic forecasts are prepared using econometric models. The CBEO is one of a handful of state forecasts that is based on expert opinion from estimating groups. While it would be interesting to compare the accuracy of the forecast to the accuracy of the econometric models, the intent of this analysis is to look at trends of the forecast committees rather than that comparison.
- The CBEO process includes sector reports prepared for each SIC by a forecast committee that includes experts in that area. The committee reports were then submitted to the Leeds research team. Revisions were made and these individual sector forecasts are then summed to derive the total for the state.

Motivation for Analysis

The following factors served as the motivation for this simplistic analysis:

- Curiosity from estimating group members about the accuracy of the forecast.
- Media reaction to Colorado's Go-Go 90s and the Lost Decade.
- Desire to provide estimating groups with better information to achieve greater accuracy.
- Desire to provide economists with an opportunity to learn from 30 years of forecasting.
- Need to provide business leaders with the tendencies/limitations of the CBEO.

During the preparation of this analysis, the following questions arose:

- Does an experienced research team, with a wealth of knowledge, produce a more accurate forecast or does the added knowledge result in an "arrogance" which may reduce the accuracy of the forecast (Owen Lamont, 2001)?
- Does financial support for the event from a private sector vendor (financial organization) and the host institution create bias in the forecast?
- Is a forecast by committee, such as the CBEO more accurate than one based on an econometric model?
- The precursor of this analysis was a presentation at an AUBER conference in 2008, which measured CBEO accuracy for a shorter period. As well, a later analysis was conducted that looked at only the total employment forecast.

Guide to Analysis of Slides

This analysis evaluated the number of jobs actually added (final revision) and the forecasted number of jobs added. The slides that follow show the actual change in annual BLS data (gray bars), with the forecasted change in red markers.

Frequency of jobs added and lost

- The number of times in 30 years that jobs were added and the committee correctly indicated that jobs would be added.
- The number of times in 30 years that jobs were lost and the committee correctly indicated that jobs would be lost.

Frequency of forecast error compared to actual value (<, >, or = actual value).

- The number of times the forecast was less than the actual value.
- The number of times the forecast was greater than the actual value.
- The number of times the forecast was equal to the actual value.

Comparison for range for actual change vs. forecast change.

- The smallest and largest changes in actual data; to show the range of actual values
- The smallest and largest changes in forecast data; to show the range of forecast values.

Measure of central tendency for actual values and AAE

- The average value of absolute change in the actual data (average actual change = AAC).
- The average value of the absolute difference between the forecast and actual data (average absolute error = AAE)

Range in absolute errors (forecast less actual values)

- The smallest error of the absolute difference between the forecast and actual data.
- The largest error of the absolute difference between the forecast and actual data.

Distribution of forecast errors based on AAE

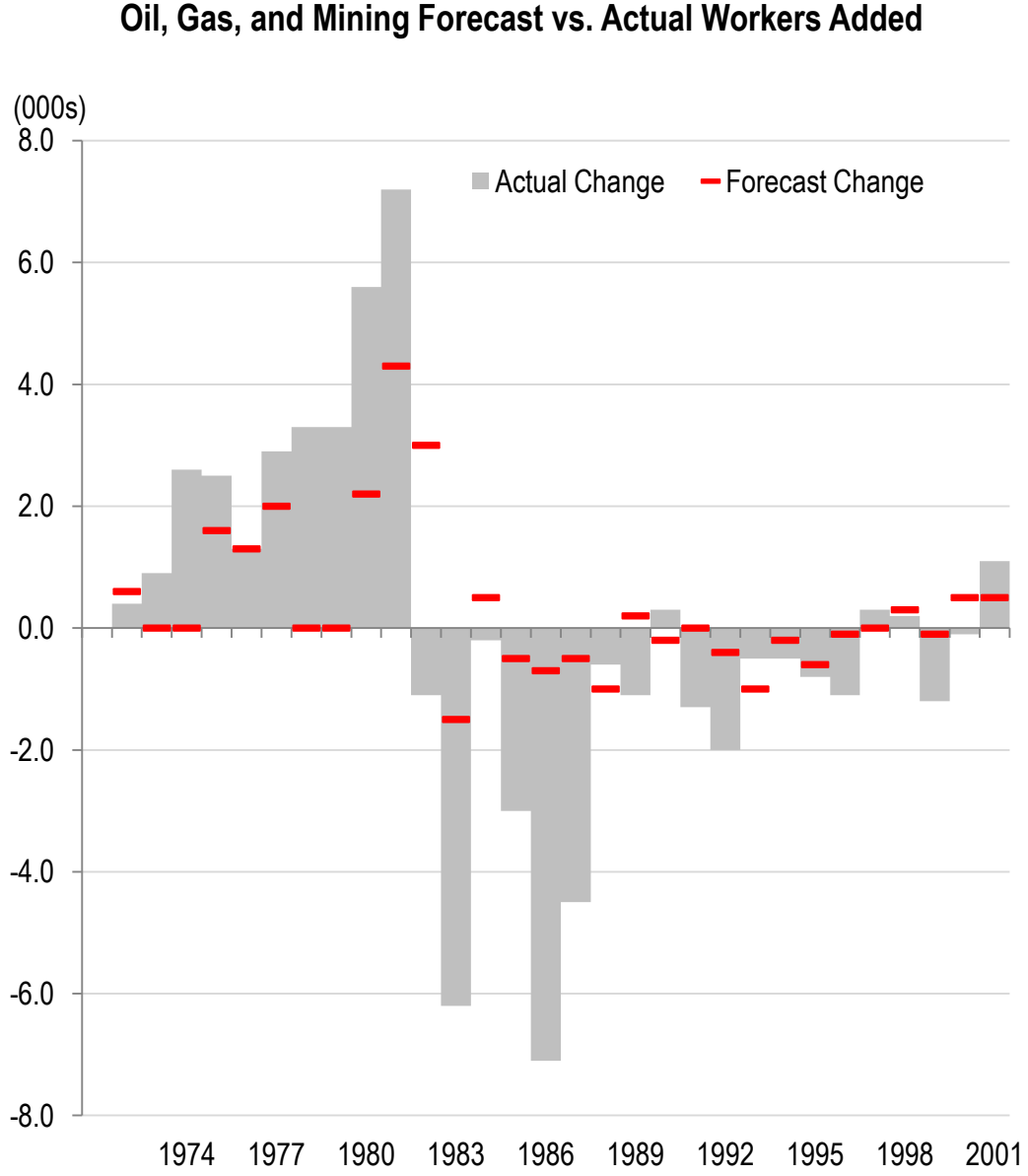
- Number of annual error values < .5 AAE
- .5 AAE ≤ Number of annual error values < AAE
- AAE ≤ Number of annual error values r < 1.5 AAE
- Number of annual error values ≥ 1.5 AAE

Goods Producing Sectors

Oil, Gas, and Mining
Forecast vs. Actual Workers Added
1972 to 2001

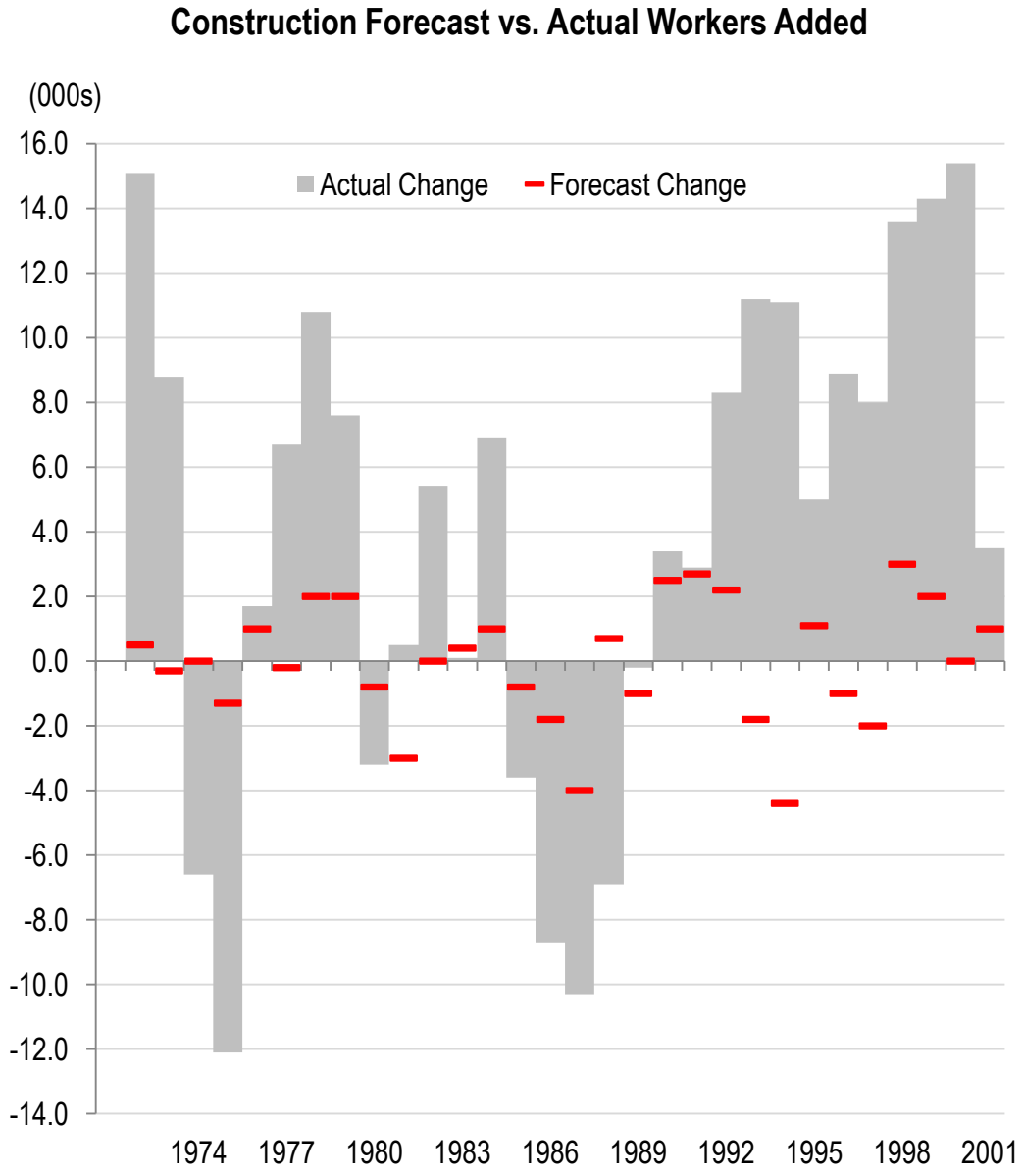
# times jobs added	13 of 14 correct
# times jobs lost	11 of 16 correct
# times forecasts < actual	13 of 30
# times forecast >actual	16 of 30
# times forecast = actual	1 of 30
Largest actual change	7,200
Smallest actual change	-7,100
Largest forecast change	4,300
Smallest forecast change	-1,500
Average absolute change	2,100
Coefficient of variation (AAC)	.996
Average absolute error(f-a)	1,700
Coefficient of variation (AAE)	.972
Smallest error abs(fcst-act)	0
Largest error abs(fcst-act)	6,400
Error < 850	12 of 30
850 ≤ error <1,700	8 of 30
1,700 ≤ error <2,550	1 of 30
Error ≥ 2,550	9 of 30

Source: BLS, NSA.



Construction
Forecast vs. Actual Workers Added
1972 to 2001

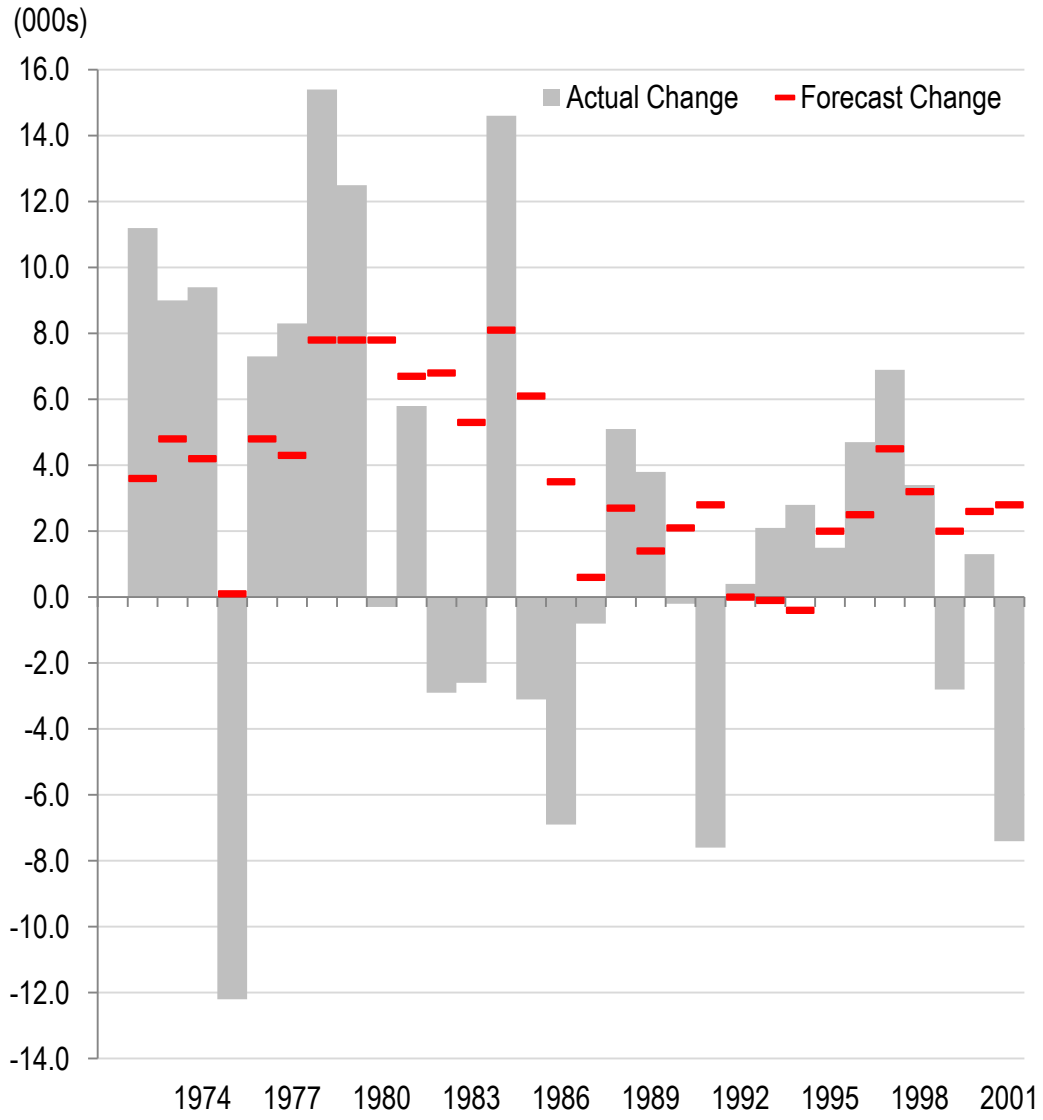
# times jobs added	15 of 21 correct
# times jobs lost	7 of 9 correct
# times forecasts < actual	22 of 30
# times forecast >actual	8 of 30
Largest actual change	15,400
Smallest actual change	-12,100
Largest forecast change	3,000
Smallest forecast change	-4,400
Average absolute change	7,400
Coefficient of variation (AAC)	.601
Average absolute error(f-a)	6,800
Coefficient of variation (AAE)	.671
Smallest error abs(fcst-act)	200
Largest error abs(fcst-act)	15,500
Error < 3,400	8 of 30
3,400 ≤ error <6,800	8 of 30
6,800 ≤ error <10,200	7 of 30
Error ≥ 10,200	7 of 30



Source: BLS, NSA.

Manufacturing
Forecast vs. Actual Workers Added
1972 to 2001

# times jobs added	18 of 20 correct
# times jobs lost	0 of 10 correct
# times forecasts < actual	16 of 30
# times forecast >actual	14 of 30
Largest actual change	15,400
Smallest actual change	-12,200
Largest forecast change	8,100
Smallest forecast change	-400
Average absolute change	5,700
Coefficient of variation (AAC)	.757
Average absolute error(f-a)	4,900
Coefficient of variation (AAE)	.733
Smallest error abs(fcst-act)	200
Largest error abs(fcst-act)	12,300
Error < 2,450	12 of 30
2,450 ≤ error <4,900	6 of 30
4,900 ≤ error <7,350	2 of 30
Error ≥ 7,350	10 of 30

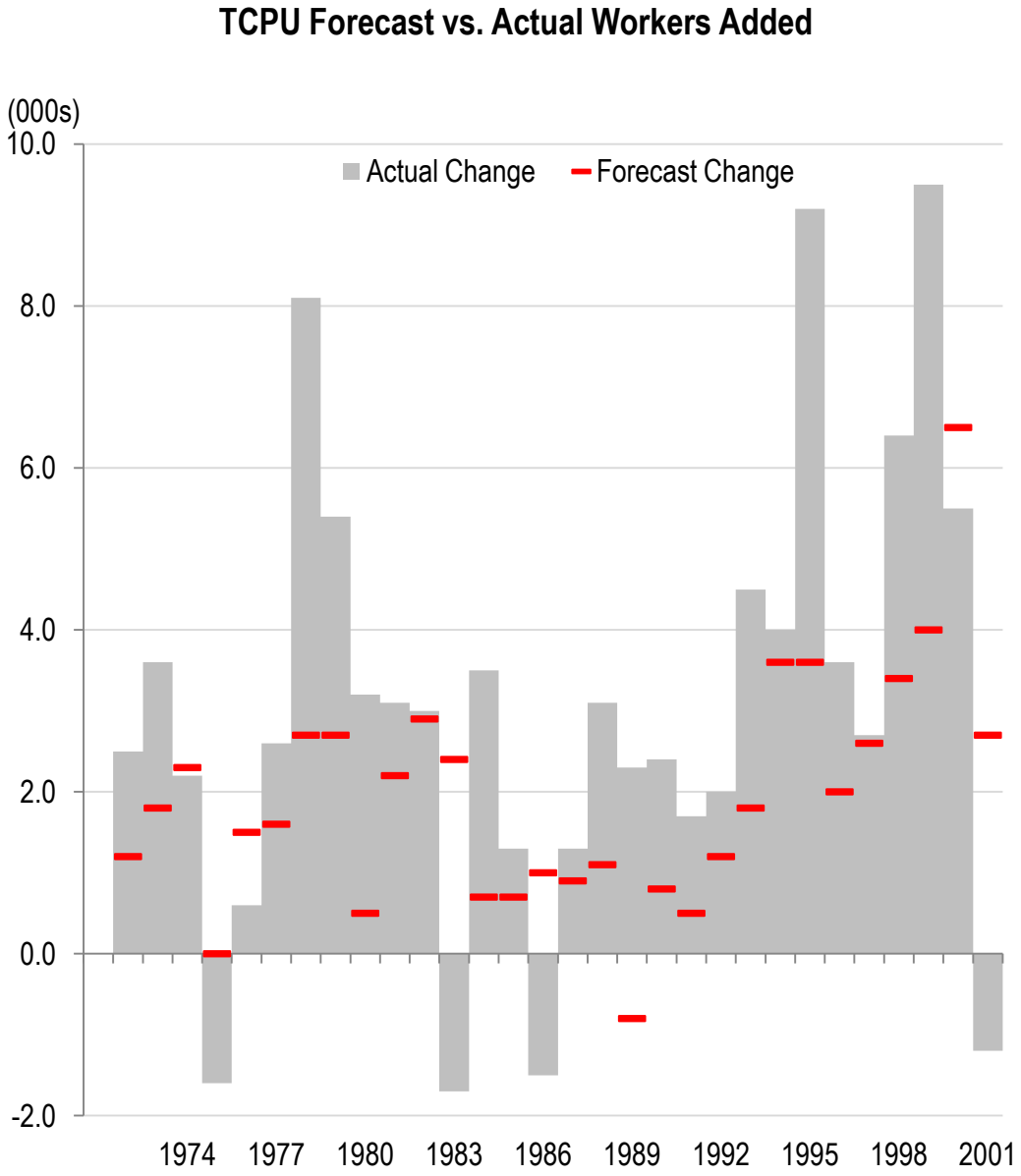


Source: BLS, NSA.

Service Producing Sectors

Transportation, Communication, and Public Utilities
Forecast vs. Actual Workers Added
1972 to 2001

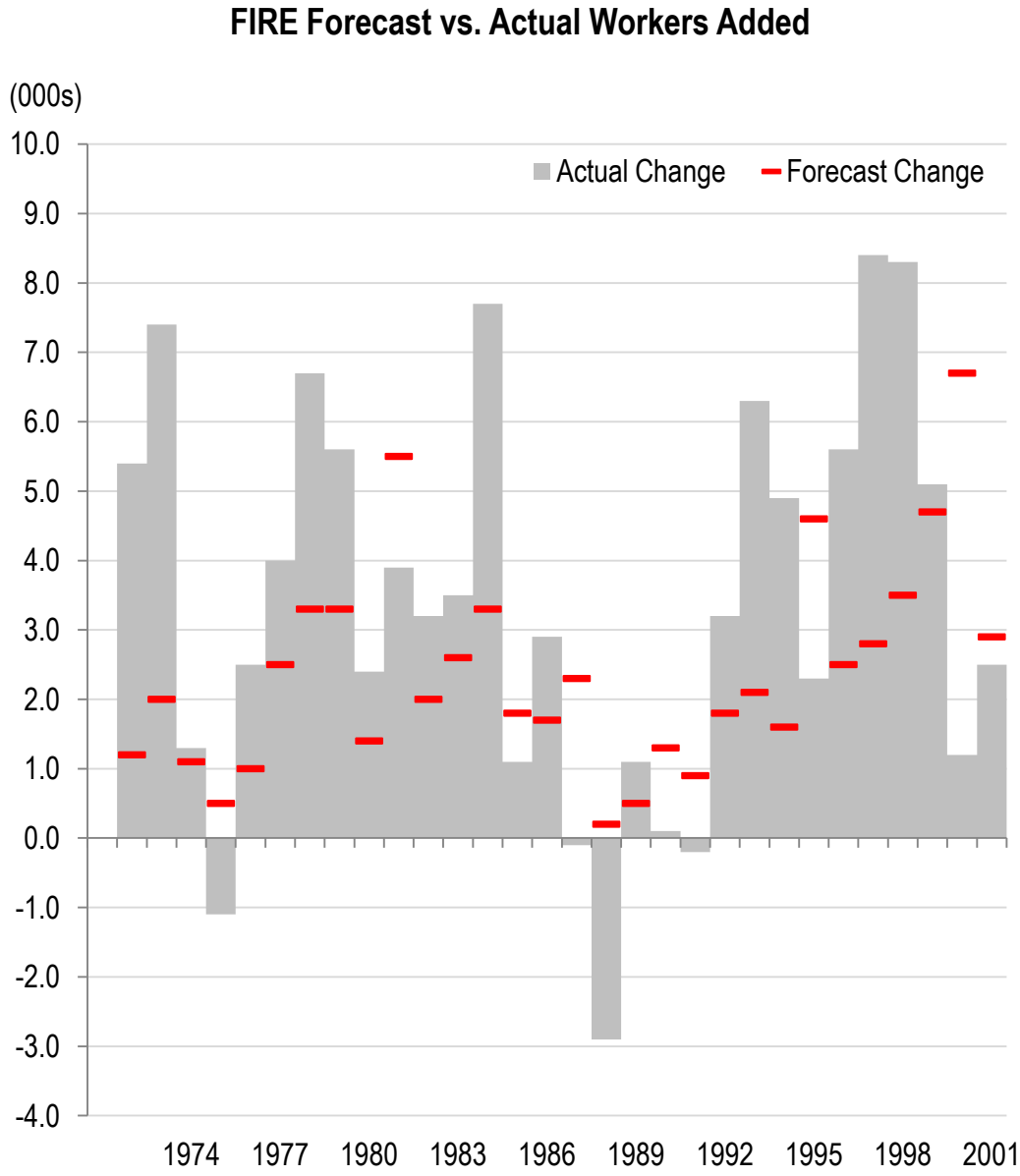
# times jobs added	25 of 26 correct
# times jobs lost	0 of 4 correct
# times forecasts < actual	23 of 30
# times forecast >actual	7 of 30
Largest actual change	9,500
Smallest actual change	-1,700
Largest forecast change	6,500
Smallest forecast change	- 800
Average absolute change	3,400
Coefficient of variation (AAC)	.669
Average absolute error(f-a)	2,000
Coefficient of variation (AAE)	.784
Smallest error abs(fcst-act)	100
Largest error abs(fcst-act)	5,600
Error < 1,000	9 of 30
1,000 ≤ error <2,000	8 of 30
2,000 ≤ error <3,000	6 of 30
Error ≥ 3,000	7 of 30



Source: BLS, NSA.

Finance, Insurance, and Real Estate Forecast vs. Actual Workers Added 1972 to 2001

# times jobs added	26 of 26 correct
# times jobs lost	0 of 4 correct
# times forecasts < actual	20 of 30
# times forecast >actual	10 of 30
Largest actual change	8,400
Smallest actual change	-2,900
Largest forecast change	6,700
Smallest forecast change	200
Average absolute change	3,700
Coefficient of variation (AAC)	.676
Average absolute error(f-a)	2,400
Coefficient of variation (AAE)	.711
Smallest error abs(fcst-act)	200
Largest error abs(fcst-act)	5,600
Error < 1,200	8 of 30
1,200 ≤ error <2,400	10 of 30
2,400 ≤ error <3,600	5 of 30
Error ≥ 3,600	7 of 30

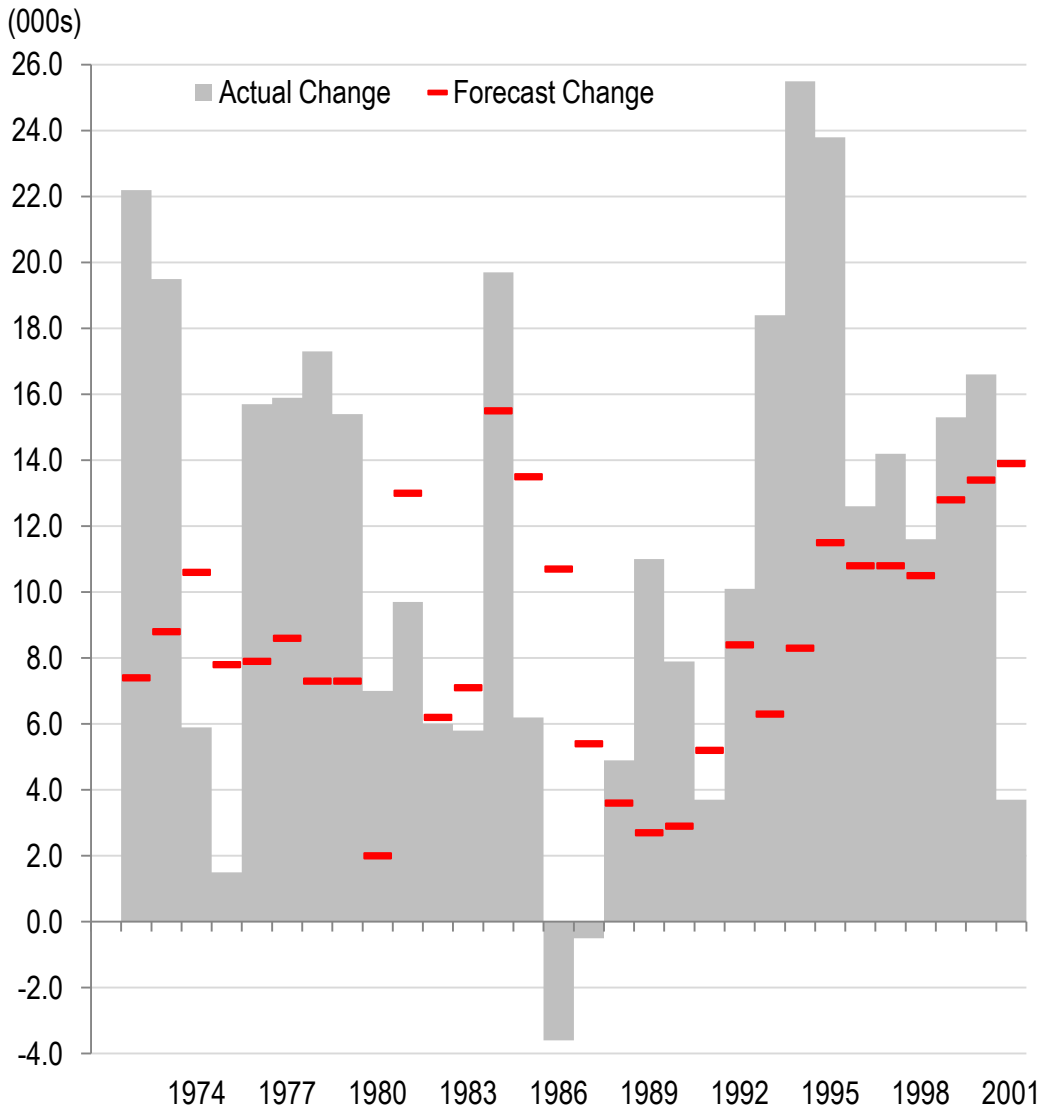


Source: BLS, NSA.

Wholesale and Retail Trade Forecast vs. Actual Workers Added 1972 to 2001

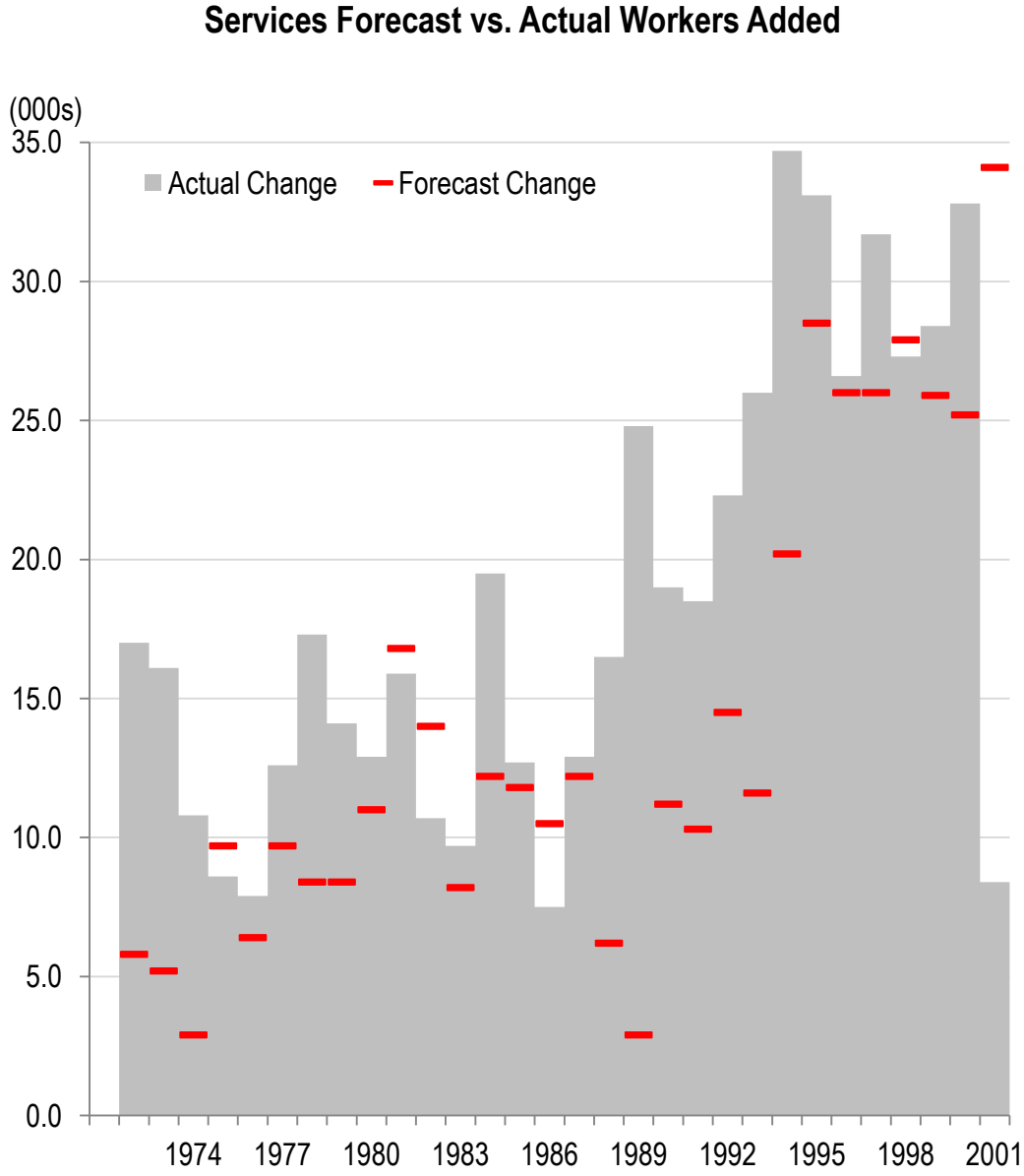
# times jobs added	28 of 28 correct
# times jobs lost	0 of 2 correct
# times forecasts < actual	20 of 30
# times forecast >actual	10 of 30
Largest actual change	25,500
Smallest actual change	-3,600
Largest forecast change	15,500
Smallest forecast change	2,000
Average absolute change	11,700
Coefficient of variation (AAC)	.590
Average absolute error(f-a)	6,400
Coefficient of variation (AAE)	.716
Smallest error abs(fcst-act)	200
Largest error abs(fcst-act)	17,200
Error < 12,300	8 of 30
12,300 ≤ error <24,600	9 of 30
24,600 ≤ error <36,900	5 of 30
Error ≥ 36,900	8 of 30

Source: BLS, NSA.



Services
Forecast vs. Actual Workers Added
1972 to 2001

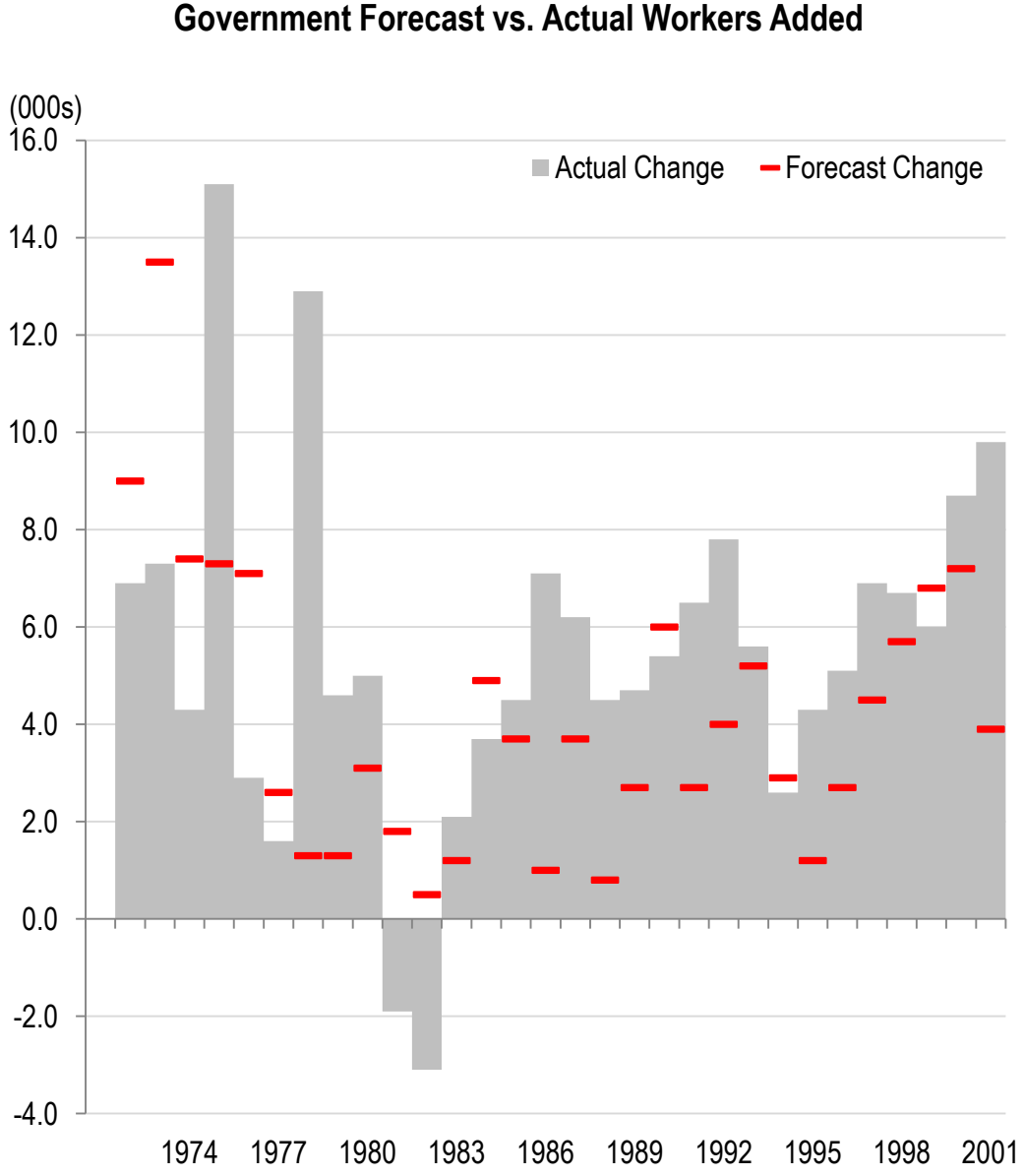
# times jobs added	30 of 30 correct
# times jobs lost	0 of 0 correct
# times forecasts < actual	24 of 30
# times forecast >actual	6 of 30
Largest actual change	34,700
Smallest actual change	7,500
Largest forecast change	34,100
Smallest forecast change	2,900
Average absolute change	18,500
Coefficient of variation (AAC)	.449
Average absolute error(f-a)	6,700
Coefficient of variation (AAE)	.926
Smallest error abs(fcst-act)	600
Largest error abs(fcst-act)	25,700
Error < 3,350	13 of 30
3,350 ≤ error <6,700	3 of 30
6,700 ≤ error <10,050	7 of 30
Error ≥ 10,050	7 of 30



Source: BLS, NSA.

Government
Forecast vs. Actual Workers Added
1972 to 2001

# times jobs added	28 of 28 correct
# times jobs lost	0 of 2 correct
# times forecasts < actual	19 of 30
# times forecast >actual	11 of 30
Largest actual change	15,100
Smallest actual change	- 3,100
Largest forecast change	13,500
Smallest forecast change	500
Average absolute change	5,800
Coefficient of variation (AAC)	.519
Average absolute error(f-a)	3,100
Coefficient of variation (AAE)	.817
Smallest error abs(fcst-act)	300
Largest error abs(fcst-act)	11,600
Error < 1,550	10 of 30
1,550 ≤ error <3,100	6 of 30
3,100 ≤ error <4,650	9 of 30
Error ≥ 4,650	5 of 30

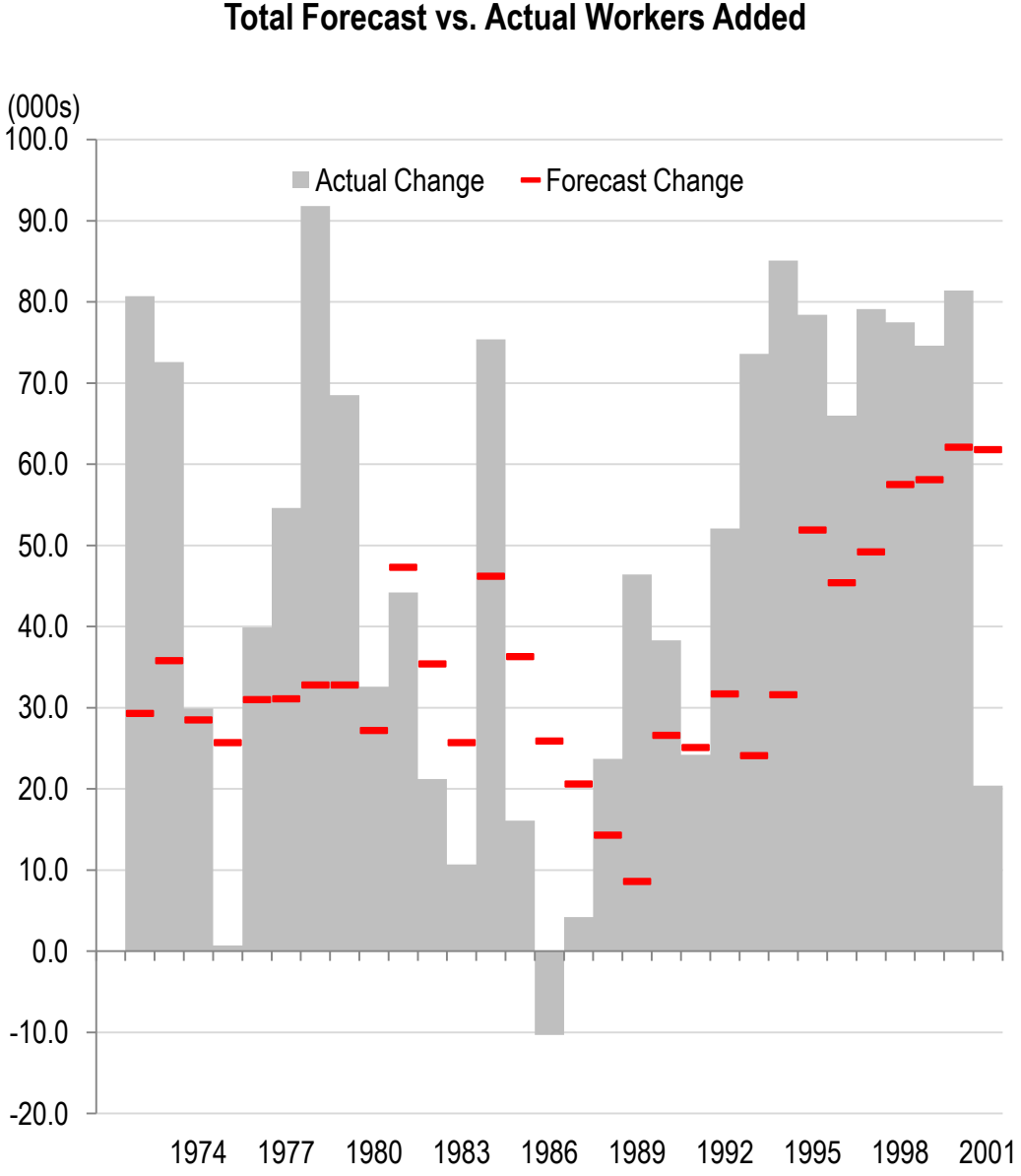


Source: BLS, NSA.

Total Employment and Summary

Total
Forecast vs. Actual Workers Added
1972 to 2001

# times jobs added	29 of 29 correct
# times jobs lost	0 of 1 correct
# times forecasts < actual	21 of 30
# times forecast >actual	9 of 30
Largest actual change	91,800
Smallest actual change	-10,300
Largest forecast change	62,100
Smallest forecast change	8,600
Average absolute change	49,100
Coefficient of variation (AAC)	.574
Average absolute error(f-a)	24,600
Coefficient of variation (AAE)	.644
Smallest error abs(fcst-act)	900
Largest error abs(fcst-act)	59,000
Error < 12,300	7 of 30
12,300 ≤ error <24,600	10 of 30
24,600 ≤ error <36,900	7 of 30
Error ≥ 36,900	6 of 30



Source: BLS, NSA.

Accuracy of Number of Times Jobs Added and Lost in 30 Years

Number of Times Jobs Added	
Services	30 of 30 correct
Trade	28 of 28 correct
Government	28 of 28 Correct
FIRE	26 of 26 correct
TCPU	25 of 26 correct
Oil, Gas, and Mining	13 of 14 correct
Manufacturing	18 of 20 correct
Construction	15 of 21 correct

Number of Times Jobs Lost	
Services	0 of 0 correct
Construction	7 of 9 correct
Oil, Gas, and Mining	11 of 16 correct
Manufacturing	0 of 10 correct
FIRE	0 of 4 correct
TCPU	0 of 4 correct
Government	0 of 2 correct
Trade	0 of 2 correct

The Services sector added jobs each of the 30 years and the forecast committee got that correct.

The Goods Producing sectors were the most volatile in terms of jobs added and jobs lost. The OGM and Construction forecast committees were fairly effective at projecting when their sectors would add or lose jobs. The Manufacturing forecast committee accurately projected job gains, but they did not effectively foretell job losses (0 for 10).

Generally, the Service Producing sectors added jobs almost every year. Only the TCPU forecast committee erred on one occasion when jobs were added. However, the Service Producing sectors forecast committees failed to correctly project years when job losses occurred. They erred every time in this situation, with the most errors being made by the FIRE and TCPU committees.

Forecast vs. Actual Employment Change (Over or Under)

Number of Times Forecast Less Than Actual

Oil, Gas, and Mining	13 of 30
Manufacturing	16 of 30
Government	19 of 30
FIRE	20 of 30
Trade	20 of 30
Construction	22 of 30
TCPU	23 of 30
Services	24 of 30
Total	21 of 30

The overall forecast underestimated employment growth in 21 of 30 years. OGM and Manufacturing were the only committees that had an over/under forecast rate near 50%. Most forecast committees had a strong tendency to under forecast.

Largest Changes (Maximum and Minimum) Forecast vs. Actual

Range of Forecasts and Actual Values
Goods Producing Sectors

Oil, Gas, and Mining		
• Actual Min	-7,100	Max 7,200
• Forecast Min	-1,500	Max 4,300
Construction		
• Actual Min	-12,100	Max 15,400
• Forecast Min	-4,400	Max 3,000
Manufacturing		
• Actual Min	-12,200	Max 15,400
• Forecast Min	- 400	Max 8,100
Total		
• Actual Min	-10,300	Max 91,800
• Forecast Min	8,600	Max 62,100

Range of Forecasts and Actual Values
Service Producing Sectors

TCPU		
• Actual Min	-1,700	Max 9,500
• Forecast Min	- 800	Max 6,500
FIRE		
• Actual Min	-2,900	Max 8,400
• Forecast Min	200	Max 6,700
Trade		
• Actual Min	-3,600	Max 25,500
• Forecast Min	2,000	Max 15,500
Services		
• Actual Min	7,500	Max 34,700
• Forecast Min	2,500	Max 34,100
Government		
• Actual Min	-3,100	Max 15,100
• Forecast Min	500	Max 13,500

With the exception of the Services Sector, the projections for most sector forecast committees were extremely conservative. In other words the sector ranges for actual employment were often much greater than the forecast ranges.

Summary of Actual Change and Forecast Error and Dispersion

Average Actual Change and Forecast Error
Goods Producing Sectors

Oil, Gas, and Mining

• Average annual absolute change	2,100
• Average absolute error (f-a) (AAE)	1,700
• # of years where error (f-a) is < AAE	20 of 30
• Coefficient of variation (AAE)	.972

Construction

• Average annual absolute change	7,400
• Average absolute error (f-a) (AAE)	6,800
• # of years where error (f-a) is < AAE	16 of 30
• Coefficient of variation (AAE)	.671

Manufacturing

• Average annual absolute change	5,700
• Average absolute error (f-a) (AAE)	4,900
• # of years where error (f-a) is < AAE	18 of 30
• Coefficient of variation (AAE)	.733

Total

• Average annual absolute change	49,100
• Average absolute error (f-a) (AAE)	24,600
• # of years where error (f-a) is < AAE	17 of 30
• Coefficient of variation (AAE)	.644

Average Actual Change and Forecast Error
Service Producing Sectors

TCPU

• Average annual absolute change	3,400
• Average absolute error (f-a) (AAE)	2,000
• # of years where error (f-a) is < AAE	17 of 30
• Coefficient of variation (AAE)	.784

FIRE

• Average annual absolute change	3,700
• Average absolute error (f-a) (AAE)	2,400
• # of years where error (f-a) is < AAE	18 of 30
• Coefficient of variation (AAE)	.711

Trade

• Average annual absolute change	11,700
• Average absolute error (f-a) (AAE)	6,400
• # of years where error (f-a) is < AAE	17 of 30
• Coefficient of variation (AAE)	.716

Services

• Average annual absolute change	18,500
• Average absolute error (f-a) (AAE)	6,700
• # of years where error (f-a) is < AAE	16 of 30
• Coefficient of variation (AAE)	.926

Government

• Average annual absolute change	5,800
• Average absolute error (f-a) (AAE)	3,100
• # of years where error (f-a) is < AAE	16 of 30
• Coefficient of variation (AAE)	.817

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Concluding Comments

- There is typically greater volatility, as measured by the coefficient of variation, in the actual employment change for sectors that have fewer employees and the goods producing sectors.
- There is no apparent pattern in the volatility of the absolute forecast error. This may be due to the fact that error values are smaller and more sensitive to change when the coefficient of variation is calculated.
- Forecast committees are very good at determining when sectors will add jobs, but very poor at determining when they will lose jobs. The two exceptions were the Construction and Oil, Gas, and Mining committees. Because they experience more volatility than other sectors, committee members appeared to be more in tune to when jobs would be added or lost.
- There is a tendency of the forecast committees to make conservative forecasts (less than the actual value) and forecast committees do not like to make negative job forecasts. On average, the amount of the error is about 50% of the total forecast value. Specifically, the average absolute annual change for all sectors is 49,100, while the average error is 24,600.

Accuracy of the Colorado Business Economic Outlook Forecast by Sector 1972 to 2001

This analysis is for informational purposes only. Any opinions or interpretations of data are those of the presenter. As such, they do not represent the viewpoints of any group or particular organization.
For further information contact Colorado-based Business and Economic Research (CBER).

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