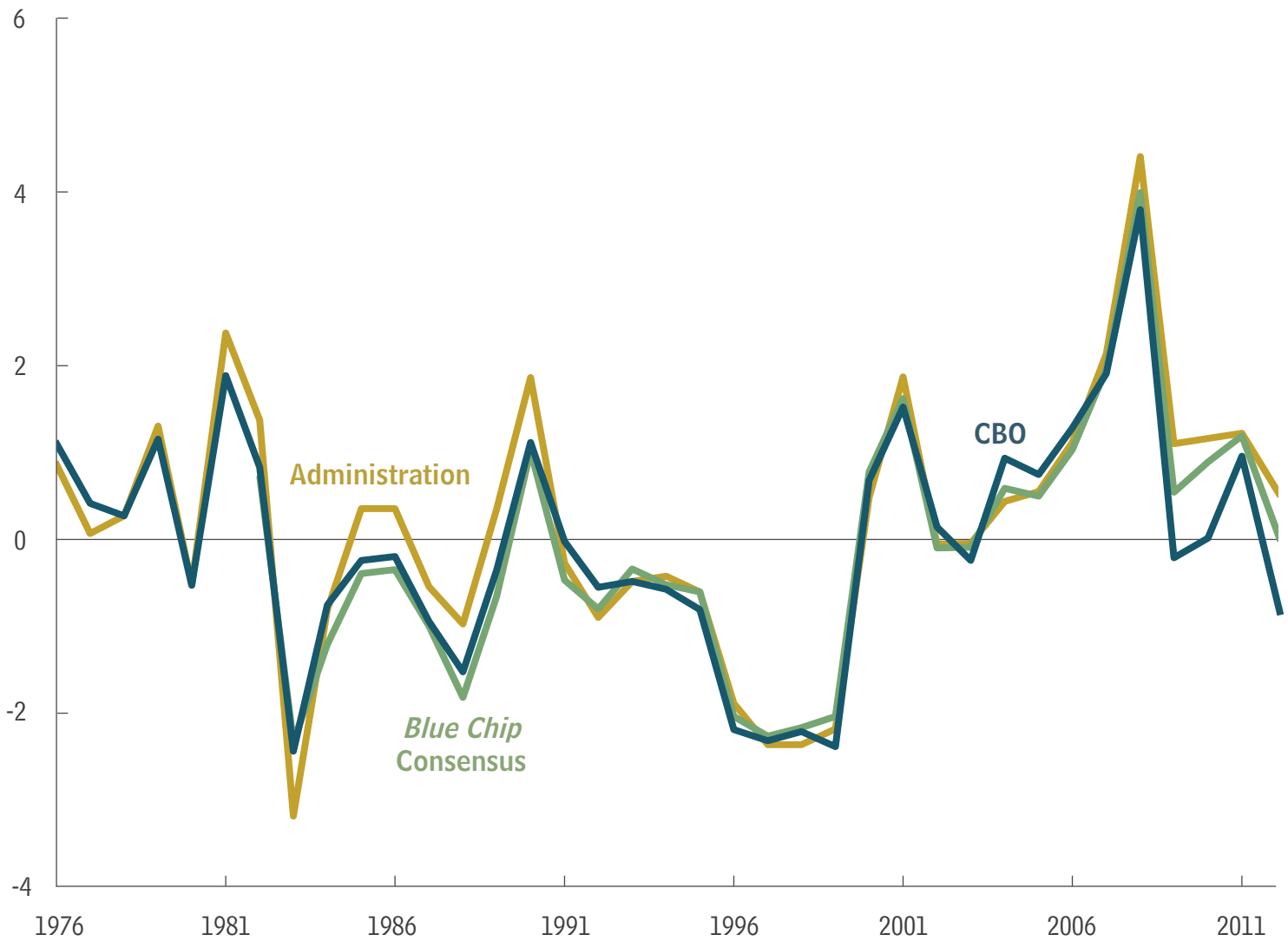


CBO

CBO's Economic Forecasting Record: 2015 Update

Percentage-Point Difference in Annual Growth Rates

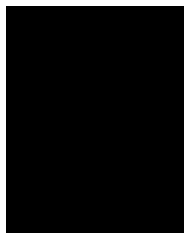


Forecast Minus Actual Growth in Inflation-Adjusted Output: Two-Year Forecasts

FEBRUARY 2015

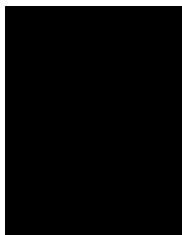
Note

Some of the figures have vertical bars that indicate the duration of recessions. (A recession extends from the peak of a business cycle to its trough.)



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CBO's Economic Forecasting Record: 2015 Update

Summary

For nearly four decades, the Congressional Budget Office has prepared economic forecasts that underlie the agency's projections for the federal budget and cost estimates for proposed federal legislation. In particular, forecasts of output, inflation, interest rates, and income play a significant role in the agency's budgetary analysis; for example, projections of wages and salaries are used to forecast individual income tax receipts.

CBO regularly evaluates the quality of its economic forecasts by comparing them with the economy's actual performance and with forecasts by the Administration (as published in the annual budget documents prepared by the Office of Management and Budget) and the *Blue Chip* consensus—an average of about 50 private-sector forecasts. Such comparisons may indicate the extent to which imperfect information and analysis might have caused CBO to “miss” patterns or turning points in the economy. They also may identify areas where CBO has tended to make larger errors than other analysts.

This report evaluates CBO's macroeconomic forecasts over two-year and five-year horizons. The periods used for the evaluations differ by variable and by forecast horizon, depending on the availability of the needed data.

How Does CBO's Forecasting Record Compare With Those of the Administration and the *Blue Chip* Consensus?

CBO's forecasts generally have been comparable in quality with those of the Administration and the *Blue Chip* consensus. When CBO's projections have proved inaccurate by large margins, the errors have tended to reflect difficulties shared by other forecasters.

Do CBO's Forecasts Exhibit Notable Bias?

A simple and widely used indicator of statistical bias is the mean error—the average tendency of a forecast to be low or high over an entire period. In general, CBO's

forecasts and those by the Administration and the *Blue Chip* consensus have had similar mean errors. Specifically, an evaluation of CBO's mean errors reaches two conclusions:

- For CBO's forecasts that look two years ahead, the mean errors since the early 1980s have generally been very small. The agency's forecasts have shown slight tendencies to overestimate future interest rates and wages and salaries (see Summary Figure 1).
- For CBO's forecasts that look five years ahead, the mean errors since the early 1980s imply a slightly stronger tendency to overestimate inflation compared with that of the agency's two-year forecasts. That tendency accounts for about half of the higher mean errors for growth in nominal output and in wages and salaries.

How Accurate Are CBO's Forecasts?

Accuracy is the degree to which forecast values are dispersed around actual outcomes. One widely used measure of accuracy is the root mean square error. By that measure, the forecasts by CBO, the Administration, and the *Blue Chip* consensus have been about equally accurate over two-year periods (see Summary Figure 2) as well as over five-year periods. Specifically, an evaluation of CBO's root mean square errors reaches two conclusions:

- Among two-year forecasts by CBO since the early 1980s, forecast values deviated from actual outcomes by 1.4 percentage points per year for real (inflation-adjusted) output growth and by 0.8 percentage points per year for inflation in the consumer price index.
- Among five-year forecasts by CBO since the early 1980s, forecast values deviated from actual outcomes by 1.2 percentage points per year for real output growth and by 0.6 percentage points per year for inflation in the consumer price index.

Summary Figure 1.**Mean Error for Two-Year Forecasts**

Percentage Points



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis; Bureau of Labor Statistics (BLS); Federal Reserve.

Notes: The mean error is the arithmetic average of the forecasting errors.

Errors are forecast values minus actual values; therefore, a positive error is an overestimate.

To compare forecast and actual data, annual averages were computed for growth rates, inflation rates, interest rates, and wages and salaries as a share of output.

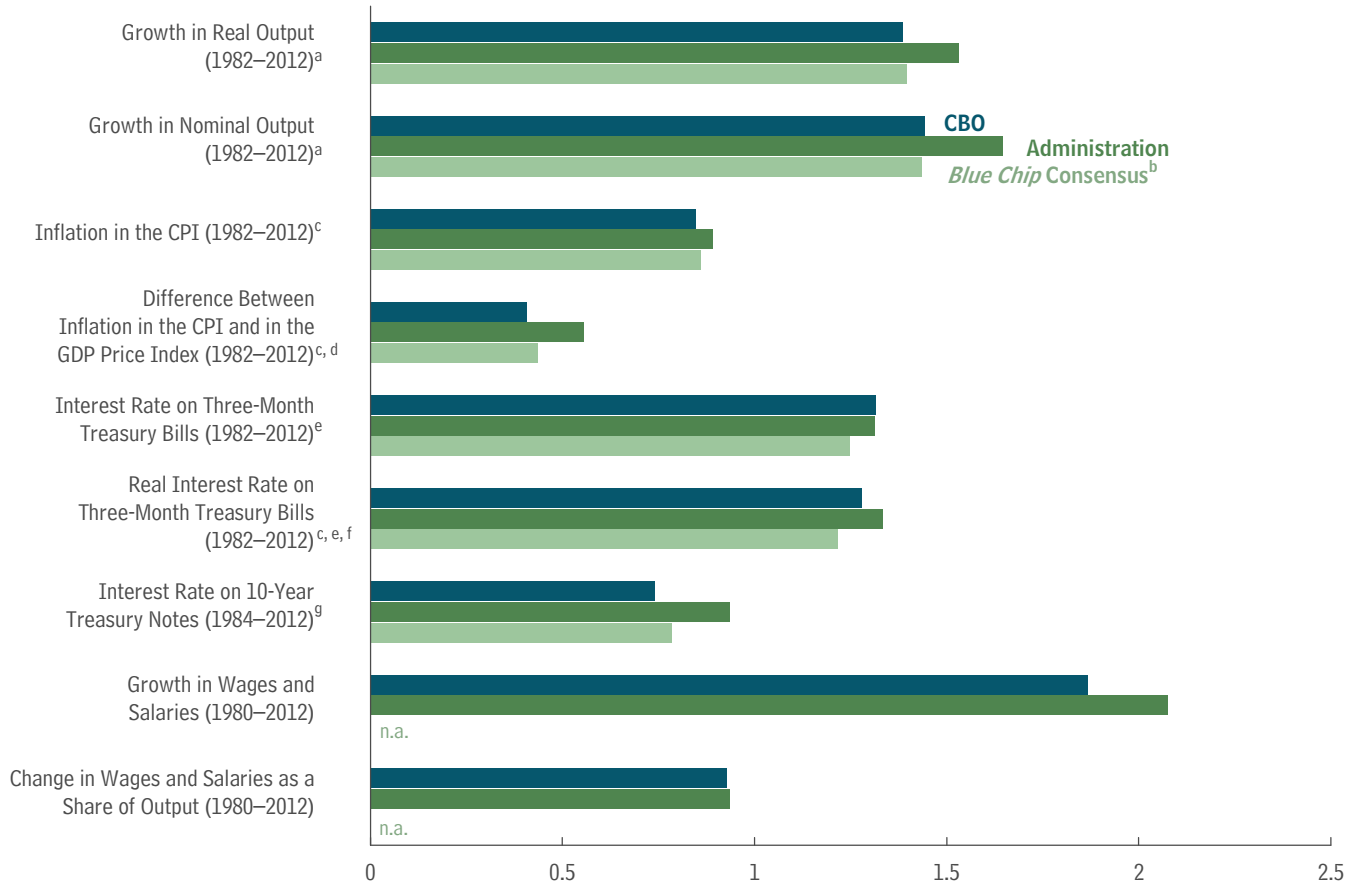
CPI = consumer price index; CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product; GNP = gross national product; n.a. = not applicable (the *Blue Chip* consensus does not report forecasts of wages and salaries).

- Output is either GDP or GNP. GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward. Real output is nominal output adjusted to remove the effects of inflation.
- The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.
- Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.
- The GNP price index was forecast before 1992; the GDP price index was forecast from 1992 onward.
- In most years, the secondary-market interest rate was forecast. However, the rate on newly issued bills was forecast by the Administration through 2000 and by the *Blue Chip* consensus from 1982 to 1985 and from 1992 to 1997.
- The real interest rate is the nominal interest rate deflated by the predicted growth in the consumer price index.
- Forecasts of the Moody's Aaa corporate bond rate were used for the years in which the interest rate on 10-year Treasury notes was not forecast: 1984 and 1985 for CBO's forecasts and 1984 through 1995 for the *Blue Chip* consensus forecasts.

Summary Figure 2.

Root Mean Square Error for Two-Year Forecasts

Percentage Points



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis; Bureau of Labor Statistics (BLS); Federal Reserve.

Notes: The root mean square error is calculated by first squaring the errors and then taking the square root of the arithmetic average of the squared errors.

To compare forecast and actual data, annual averages were computed for growth rates, inflation rates, interest rates, and wages and salaries as a share of output.

CPI = consumer price index; CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product; GNP = gross national product; n.a. = not applicable (the *Blue Chip* consensus does not report forecasts of wages and salaries).

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What Are Some Sources of Forecasting Errors?

Sources of large forecasting errors have included the difficulty of predicting the following:

- Turning points in the business cycle—the beginning and end of recessions,
- Changes in trends in productivity, and
- Changes in crude oil prices.

In addition, revisions to the historical data (on output and income, for example) that forecasters use for economic projections can complicate the task of interpreting forecasting errors. CBO uses current versions of historical data to compute the forecasting errors and statistics. Had the revised data been available to forecasters, rather than the original information that was available when the forecasts were produced, the forecasts themselves would have been different. Despite that complication, recently published data present a simple and consistent point of comparison for evaluating forecasts by CBO and others.

Do Assumptions About Fiscal Policy Affect Forecasting Errors?

Different assumptions about fiscal policy can account for some of the differences between forecasts, and thus differences in forecasting errors. CBO constructs its economic projections under the assumption that federal fiscal policy will generally follow current law, thereby providing a benchmark for lawmakers as they consider potential changes in the law. In contrast, the Administration's forecasts reflect the assumption that policies included in the President's proposed budget will be adopted. Forecasters in the private sector (represented in the *Blue Chip* consensus) form their own assumptions about the future stance of federal fiscal policy, which may anticipate changes in law.

Different assumptions about fiscal policy can matter particularly when policymakers are considering major changes to current law. For example, in 2009 and 2010, different fiscal policy assumptions caused CBO's two-year forecasts of real output growth to diverge noticeably from those of the Administration and the *Blue Chip* consensus.

Introduction

Released on a regular basis since 1976, the Congressional Budget Office's macroeconomic forecast is an input for the agency's projections for the federal budget and cost estimates for proposed federal legislation. For example,

projections of wages and salaries feed into the forecast of individual income tax receipts.

CBO regularly evaluates the quality of its economic forecasts by comparing them with the economy's actual performance and with forecasts by the Administration (as published in the annual budget documents prepared by the Office of Management and Budget) and the *Blue Chip* consensus (an average of approximately 50 private-sector forecasts that is published periodically in the *Blue Chip Economic Indicators*). Such comparisons help CBO improve its economic projections. Specifically, they may indicate the extent to which imperfect information and analysis—factors that affect all forecasters—might have caused CBO to miss patterns or turning points in the economy.¹ They also may identify areas where CBO has tended to make larger errors than other analysts, which perhaps implies that the agency has not effectively used available information. Comparisons with the *Blue Chip* consensus forecast are particularly helpful in that regard, because the variety of forecasts it embodies is produced from a broader blend of sources and methods than can be expected from any single forecaster. Consequently, over time, the *Blue Chip* consensus forecasts may provide better estimates than those by any single forecaster.²

Despite their value, comparisons of forecasting errors can be misleading when forecasts are made for different purposes. In particular, forecasters in the private sector attempt to predict the future stance of federal fiscal policy, and the Administration's forecasts assume the adoption of the fiscal policy reflected in the President's proposed budget. CBO, however, is required to assume that fiscal policy in the future will generally reflect the provisions in current law, an approach that derives from the agency's responsibility to provide a benchmark for lawmakers as they consider proposed changes in law. Forecasting errors may be driven by those different assumptions, particularly when policymakers are

1. See David Reifschneider and Peter Tulip, *Gauging the Uncertainty of the Economic Outlook From Historical Forecasting Errors*, Finance and Economics Discussion Series Working Paper 2007-60 (Board of Governors of the Federal Reserve System, November 2007).
2. See, for example, Andy Bauer and others, "Forecast Evaluation With Cross-Sectional Data: The *Blue Chip* Surveys," *Economic Review*, vol. 88, no. 2 (Federal Reserve Bank of Atlanta, 2003), pp. 17–31; Henry Townsend, "A Comparison of Several Consensus Forecasts," *Business Economics*, vol. 31, no. 1 (January 1996); and Robert Clemen, "Combining Forecasts: A Review and Annotated Bibliography," *International Journal of Forecasting*, vol. 5, no. 4 (1989), pp. 559–583.

considering major changes in the fiscal policy embedded in current law.³

This report evaluates CBO's macroeconomic forecasts over two-year and five-year horizons, and the time periods used for the evaluations differ by variable and by forecast horizon. The forecasts by CBO and the Administration included in the evaluation were originally published in the early months of the years 1976 through 2012. Forecasts published in early 2013 were not included because full-year historical data did not extend beyond 2013 when the analysis for this report was completed. The first two-year forecast by the *Blue Chip* consensus that CBO used for this evaluation was released in early 1982; five-year forecasts by the *Blue Chip* consensus were first published in early 1979 for real output and in early 1983 for inflation in consumer prices.⁴

Relative to the forecasting record that CBO published in 2013, this evaluation now includes two-year forecasts conducted in 2011 and 2012 and five-year forecasts conducted in 2008 and 2009.⁵ Those additional forecasts did not significantly alter findings from the previous forecasting record—namely, that the quality of CBO's two- and five-year forecasts is similar to that of other organizations.

Measuring the Quality of Forecasts

Like CBO's earlier studies of its economic forecasts, this evaluation focuses on two indicators of quality: statistical bias and accuracy. Other characteristics of forecast quality—such as the efficiency with which a forecast uses available information—are harder to assess.⁶

Statistical Bias. Statistical bias indicates the tendency of a forecast to err in a certain direction. To measure statistical bias, CBO used the mean error—the arithmetic average of the forecasting errors, which is the simplest and most widely used measure. Because it is a simple average, however, underestimates and overestimates offset one another.

As a result, the mean error imperfectly measures the quality of a forecast: A small mean error would result if all of the errors were small or if large overestimates and underestimates generally balanced one another. As an alternative to the mean error measure, several studies by analysts outside of CBO have used more elaborate techniques to test for bias in the agency's forecasts.⁷

Accuracy. The accuracy of a forecast is the degree to which forecast values are dispersed around actual outcomes. Narrower dispersion indicates greater accuracy. CBO used two measures of accuracy in its evaluation: the mean absolute error and the root mean square error. The mean absolute error—the arithmetic average of the forecasts' errors without regard to sign—does not allow underestimates and overestimates to offset each other, unlike the mean error. The root mean square error also shows

3. Different assumptions about monetary policy also can create differences between CBO's forecasts and other forecasts. CBO's assumptions about monetary policy reflect the economic environment that CBO expects under the fiscal policy specified in current law.
4. The appendix to this report gives further details on the choice of historical time-series data and on the sources of forecast data for the comparisons.
5. See Congressional Budget Office, *CBO's Economic Forecasting Record: 2013 Update* (January 2013), www.cbo.gov/publication/43846.

6. For studies that have examined the relative efficiency of CBO's economic forecasts, see Michael T. Belongia, "Are Economic Forecasts by Government Agencies Biased? Accurate?" *Review*, vol. 70, no. 6 (Federal Reserve Bank of St. Louis, November/December 1988), pp. 15–23; Stephen M. Miller, "Forecasting Federal Budget Deficits: How Reliable Are U.S. Congressional Budget Office Projections?" *Applied Economics*, vol. 23 (December 1991), pp. 1789–1799; and Robert Krol, "Forecast Bias of Government Agencies," *Cato Journal*, vol. 34, no. 1 (Winter 2014). Although statistical tests can identify sources of inefficiency in a forecast after the fact, they generally do not indicate how such information could be used to improve forecasts when they are being made.
7. One such alternative approach to testing a forecast for bias is based on linear regression analysis of actual values against forecast values. For details of that method, see Jacob A. Mincer and Victor Zarnowitz, "The Evaluation of Economic Forecasts," in Jacob A. Mincer, ed., *Economic Forecasts and Expectations: Analysis of Forecasting Behavior and Performance*: National Bureau of Economic Research, 1969). Studies that have used that method to evaluate short-term forecasts published by CBO and the Administration have not found statistically strong evidence of bias over short forecast horizons. See, for example, George A. Krause and James W. Douglas, "Institutional Design Versus Reputational Effects on Bureaucratic Performance: Evidence From U.S. Government Macroeconomic and Fiscal Projections," *Journal of Public Administration Research and Theory*, vol. 15, no. 2 (April 2005), pp. 281–306; J. Kevin Corder, "Managing Uncertainty: The Bias and Efficiency of Federal Macroeconomic Forecasts," *Journal of Public Administration Research and Theory*, vol. 15, no. 1 (January 2005), pp. 55–70; Michael T. Belongia, "Are Economic Forecasts by Government Agencies Biased? Accurate?" *Review*, vol. 70, no. 6 (Federal Reserve Bank of St. Louis, November/December 1988), pp. 15–23; and Robert Krol, "Forecast Bias of Government Agencies," *Cato Journal*, vol. 34, no. 1 (Winter 2014). For a more elaborate study of bias that included CBO's forecasts among a sizable sample, see Corder, "Managing Uncertainty"; and David Laster, Paul Bennett, and In Sun Geoum, *Rational Bias in Macroeconomic Forecasts*, Staff Report No. 21 (Federal Reserve Bank of New York, March 1997).

the size of the error without regard to sign, but it gives greater weight to larger errors.⁸

Limitations of the Forecast Evaluations

There are several reasons for caution in drawing conclusions from this evaluation of CBO's forecasts:

- Historical track records only weakly indicate the possible direction or size of inaccuracies in the future. To some extent, that fact results from changes in procedures used to develop economic forecasts by CBO and other analysts over the past three decades. Moreover, the forecasters included in the *Blue Chip* consensus have varied over time.
- When preparing forecasts, CBO, unlike private forecasters and the Administration, generally does not assume any future changes in federal fiscal policy other than those prescribed in current law.⁹
- The Administration's forecasts normally include the projected economic effects of the Administrations' policy proposals. The private forecasters included in the *Blue Chip* survey make their own assumptions about fiscal policy, but the survey does not report them.
- The common practice of revising statistical data could mean that forecasters make predictions about one concept of an economic variable and the statistical agencies that compile those data ultimately report on a materially different concept. For example, in 1999, the Bureau of Economic Analysis (BEA) redefined business and government spending on computer software as investment, which led to significant revisions to historical estimates of investment, particularly during much of the 1990s.¹⁰

8. The root mean square error is calculated by first squaring the errors and then taking the square root of the arithmetic average of the squared errors. Squaring the errors places greater weight on larger errors.

9. The purpose of current-law assumptions in CBO's economic forecasts is explored in Congressional Budget Office, *What Is a Current-Law Economic Baseline?* (June 2005), www.cbo.gov/publication/16558.

10. Previously, business and government spending on software was considered to be the purchasing of an intermediate good—an input in the production process and not a component of gross domestic product.

Some Sources of Forecasting Error

The physicist Niels Bohr is credited with saying “Prediction is very difficult, especially if it's about the future.” There are indeed many ways that economic forecasts can go wrong. Some key sources of error include the difficulties of predicting turning points in the business cycle, changes in productivity trends, and changes in crude oil prices. Moreover, revisions to historical data used by forecasters can complicate the interpretation of forecasting error.

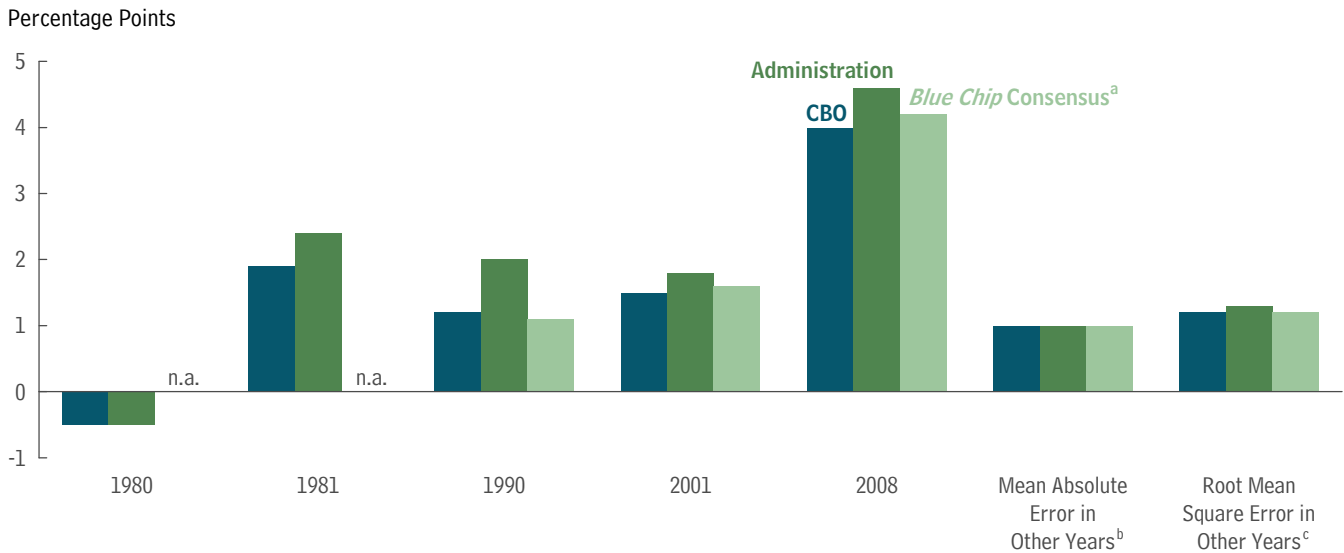
Business Cycle Turning Points

Peaks and troughs (together known as turning points) in the business cycle mark the beginning and end of recessions, which are periods of significant contraction in economic activity. Forecasts by CBO, the Administration, and the *Blue Chip* consensus have made large over-predictions of real output growth before each recession since 1976, with the exception of the 1980 recession (see Figure 1). Forecasting errors tend to be large around business cycle peaks for a number of reasons:

- Recessions are sometimes prompted by events or shocks that cannot be reasonably predicted by forecasters. For example, in August 1990, the Iraqi invasion of Kuwait led to a spike in oil prices and a drop in consumer confidence, which probably contributed to the recession that followed.
- Economists cannot be sure that a recession has begun until sufficient data are available. For example, the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER) did not announce the December 2007 business cycle peak until 11 months later. For that reason, forecasters may miss a recession even after it has started.
- Business cycle turning points often occur during periods of high uncertainty. For example, in January 2008, one month after the business cycle peak, CBO reported, “The economic outlook this year is particularly vulnerable to uncertainty about the degree to which the problems in the housing and financial markets will spill over to affect other sectors of the economy. Growth in 2008 could be weaker than CBO expects if the turmoil in the financial markets leads to a more severe economywide curtailment of lending

Figure 1.

Errors in Forecasting the Two-Year Growth of Real Output Near Business Cycle Peaks



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis (BEA).

Notes: Errors are shown for forecasts of the average annual growth rate of real output over two-year periods. Errors are forecast values minus actual values; therefore, a positive error is an overestimate. Errors are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Real (inflation-adjusted) output is either real gross domestic product (GDP) or real gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

Errors are shown for forecasts conducted near business cycle peaks in January 1980, July 1981, July 1990, March 2001, and December 2007. The dates of business cycle peaks are defined by the Business Cycle Dating Committee of the National Bureau of Economic Research.

n.a. = not available.

- a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.
- b. As a point of comparison, the mean absolute error is one indicator of the accuracy of forecasts over the 1982–2012 period, excluding those produced near a business cycle peak. The measure is the arithmetic average of forecasting errors without regard to sign.
- c. As a point of comparison, the root mean square error is one indicator of the accuracy of forecasts over the 1982–2012 period, excluding those produced near a business cycle peak. The measure is calculated by first squaring the errors and then taking the square root of the arithmetic average of the squared errors.

than CBO anticipates.”¹¹ Under such uncertain conditions, widely different outcomes can appear equally probable, making it difficult to gauge whether an economic downturn is imminent.

Changes in Productivity Trends

Forecasts of productivity growth play a critical role in forecasting potential output, which is CBO’s estimate of the amount of output that the economy would produce with a high rate of use of its capital and labor resources. As such, CBO’s forecast of potential output shows how much the economy can sustainably grow during periods of expansion and determines the trajectory of gross domestic product (GDP) in the later years of the agency’s 10-year forecasts.

11. Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008 to 2018* (January 2008), p. 21, www.cbo.gov/publication/41661.

Labor productivity is the average real output per hour of work; by definition, real output equals labor productivity times the total number of labor hours worked. Some sources of growth in labor productivity include:

- Capital accumulation (more tools, equipment, structures, and infrastructure),
- Education and skills development (also called investment in human capital), and
- Innovation (the greater efficiency achieved through better capital, systems, or methods).

When forecasting productivity growth, CBO considers historical trends in capital accumulation and the effects of public policy on incentives to invest. Shifts in such trends may be difficult to identify until several years after the fact. Consequently, forecasters may make incorrect assumptions about the trajectory of productivity growth and, therefore, potential output growth.

Since the early 1970s, forecasting errors reveal three unexpected shifts in productivity trends: after 1973, after 1995, and since 2007 (see Figure 2). In the years following 1973, labor productivity growth in the nonfarm business sector did not return to the previous trend rate of about 2½ percent per year. Over the next two decades, productivity grew more slowly, by about 1½ percent per year. Partly because most forecasters in the 1970s assumed that the productivity trend of the previous decades would prevail, their forecasts of real output in the mid- to late 1970s turned out to be too optimistic. Partly for the same reason, forecasters repeatedly underestimated inflation in the late 1970s.

After 1995, growth in labor productivity in the nonfarm business sector accelerated to nearly 3 percent per year on average. In part because most forecasters underestimated, in several consecutive years, the trend rate of productivity growth, their predictions of the economy's growth rate were too low and their predictions of inflation were too high.¹² As the economy continued to perform above expectations, analysts put more effort into investigating

the possible causes of the increase in productivity growth. Those investigations initially focused on the possible contribution of technological progress that improved and quickened the flow of information among producers and between producers and consumers. Using revised data on production and inputs to production, CBO now estimates that an increase in the amount of capital (buildings, equipment, and software) per worker—sometimes called capital deepening—was the primary source of the faster growth in productivity in the late 1990s.¹³

Since 2007, the growth of labor productivity has been noticeably slower than its previous trend. Part of the slowdown is cyclical, related to the decline in output during the severe 2007–2009 recession and the slow growth of output since then. CBO estimates that another part of the slowdown is a permanent effect of the recession, which delayed how quickly resources are reallocated to their most productive uses, slowed the rate at which workers gained new skills as technologies evolve, and curtailed businesses' spending on capital and research and development. That unexpectedly slow growth in productivity may be one reason forecasters have generally overpredicted the growth of output since the end of the recession.

In addition to misestimating labor productivity, making incorrect assumptions about growth in labor hours may also cause large forecasting inaccuracies. In the early 2000s, for example, productivity continued to grow at the strong post-1995 rate; however, labor hours unexpectedly grew very little, on average (see Figure 2). As a result, forecasters tended to overestimate the growth of real output during that period.

Changes in Crude Oil Prices

Prices for crude oil have fluctuated over a wide range in the past 40 years, creating sizable shifts in the price of petroleum imports and sometimes in overall consumer prices (see Figure 3). The effect of those fluctuations on overall inflation largely stems from the fact that crude oil is an important energy source. In the United States, petroleum accounts for more than one-third of total energy consumption.¹⁴

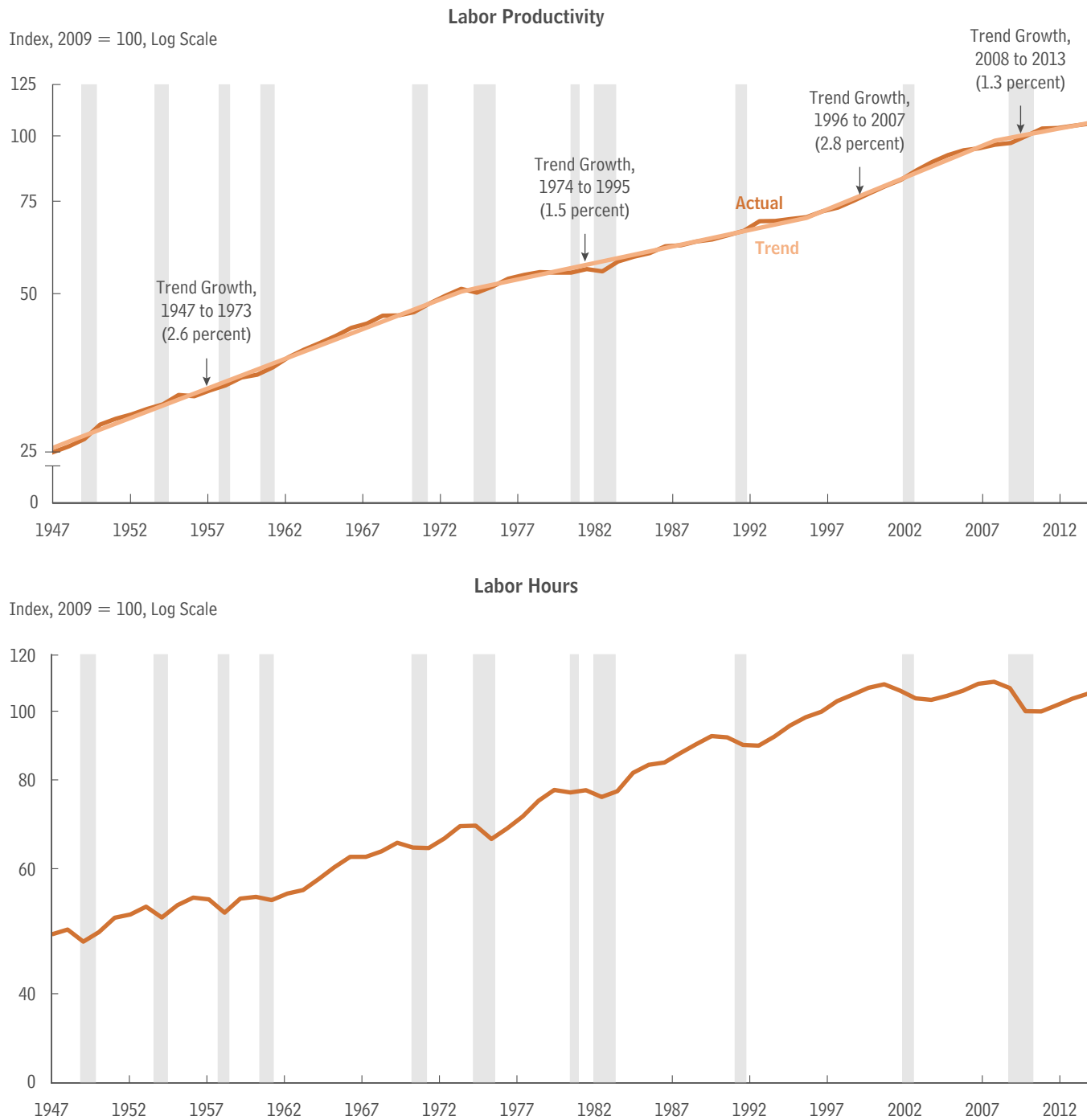
12. See Spencer Krane, "An Evaluation of Real GDP Forecasts: 1996–2001," *Economic Perspectives*, vol. 27, no. 1 (Federal Reserve Bank of Chicago, 2003), pp. 2–21; and Scott Schuh, "An Evaluation of Recent Macroeconomic Forecast Errors," *New England Economic Review* (Federal Reserve Bank of Boston, January/February 2001), pp. 35–56.

13. See Congressional Budget Office, *Labor Productivity: Developments Since 1995* (March 2007), www.cbo.gov/publication/18469.

14. See Energy Information Administration, *Monthly Energy Review* (December 2014), Table 1.3, www.eia.gov/totalenergy/data/monthly/archive/00351412.pdf (5.4 MB).

Figure 2.

Labor Productivity and Hours



Sources: Congressional Budget Office; Bureau of Labor Statistics.

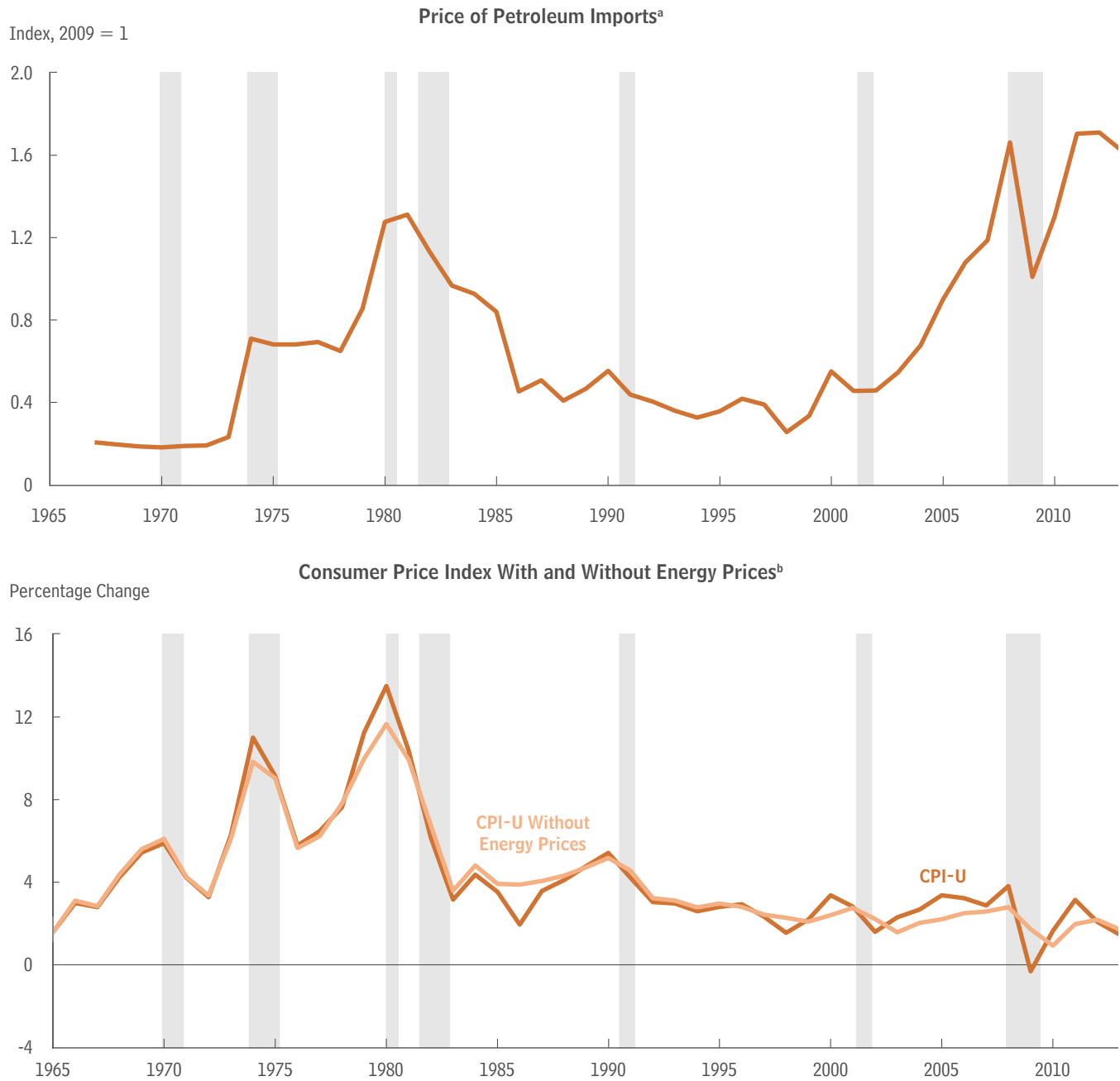
Notes: Data show labor productivity and hours in the nonfarm business sector.

Labor productivity is inflation-adjusted output divided by hours worked.

Data are annual and are plotted through 2013.

Figure 3.

Petroleum Prices and Consumer Price Inflation



Sources: Congressional Budget Office; Bureau of Labor Statistics; Bureau of Economic Analysis.

Notes: Data are annual and are plotted through 2013. Data for the price of petroleum imports are plotted beginning in 1967.

CPI-U = consumer price index for all urban consumers.

- a. The price of petroleum imports is the price index for petroleum imports divided by the price index for personal consumption expenditures excluding prices for food and energy.
- b. In the CPI-U, major components of energy prices include motor fuel (which is primarily composed of petroleum products), electricity, and natural gas purchased from utilities.

At a fundamental level, the risk of large movements in crude oil prices stems from the fact that producers and consumers have limited capacity to adjust supply and demand quickly in response to changing market conditions.¹⁵ Fluctuations in oil prices are often difficult to forecast because markets for petroleum products can be sensitive to influences that are not reasonably predictable. In particular, sudden price changes have occurred because of political decisions or instability in oil-producing countries. During the 1973–1981 period, for example, oil prices spiked at the time of the Arab oil embargo (1973 to 1974), the Iranian Revolution (1979), and the start of the Iran–Iraq War (1980).

In large part, CBO bases its forecasts of oil prices on the prices implied by oil futures contracts, adjusted for estimated economic conditions assuming federal fiscal policy as specified in current law. Although futures markets provide some predictive power, they are imperfect indicators of realized prices.

Revisions to Historical Data

Forecasters rely on national data sets to project commonly used indicators of economic activity. Agencies like BEA estimate GDP and other economic indicators using various methods and statistical definitions and using data that they and others collect. As more information becomes available and as definitions and methodologies improve, published estimates are often revised. Some series, such as the consumer price index and interest rates examined in this report, are not revised.

Revisions to historical data sometimes complicate the task of evaluating forecasts by making it difficult to assess the extent to which errors were derived from imperfect forecasting approaches as opposed to imperfect data. For example, BEA made several downward revisions to estimates of real GDP growth during the 2007–2009 recession (see Figure 4). When CBO conducted its January 2009 baseline forecast, real GDP had reportedly fallen by 0.5 percent (at an annual rate) in the third quarter of 2008; however, revised data now show a 1.9 percent drop in that quarter.

15. In the near term, consumers are constrained by the energy efficiency of their homes, places of work, and modes of transportation; producers are constrained by their equipment, technology, and the availability and accessibility of natural resources. For additional discussion, see Congressional Budget Office, *Energy Security in the United States* (May 2012), www.cbo.gov/publication/43012.

Similarly, current data show that average annual growth in real GDP was about one-half of a percentage point lower during the recession than forecasters knew in January 2010. Had CBO and other forecasters used revised data rather than original estimates, their projections probably would have been different.

Changes to definitions and methodologies also affect the comparability of current data and past forecasts. For example, in 1999, in addition to redefining business and government spending on computer software as investment, BEA adopted new price indexes for various categories of consumption. Largely as a result of those changes, estimated growth in real GDP increased during the 1980s and 1990s. In particular, from 1992 to 1998, average annual growth in real GDP was increased by 0.4 percentage points, and inflation in the GDP price index was decreased by 0.1 percentage points.¹⁶ Forecasts before 1999, of course, could not have anticipated those changes, so they used the definitions and methodologies that existed at the time.

CBO's Two-Year Forecasts

CBO's two-year forecasts have been about as accurate, as measured by the root mean square error, as those by the Administration and the *Blue Chip* consensus (see Table 1). The evaluation of those forecasts presented here involves various economic outcomes, including growth in output (in both real and nominal terms), inflation, the difference between inflation in the consumer price index and the GDP price index, interest rates on 3-month Treasury bills and 10-year Treasury notes, and changes in wages and salaries (a significant part of taxable income).¹⁷ (Box 1 on page 14 presents a comparison of CBO's forecasts of real output growth and inflation over two-year periods with those of the Federal Reserve.)

Growth in Output

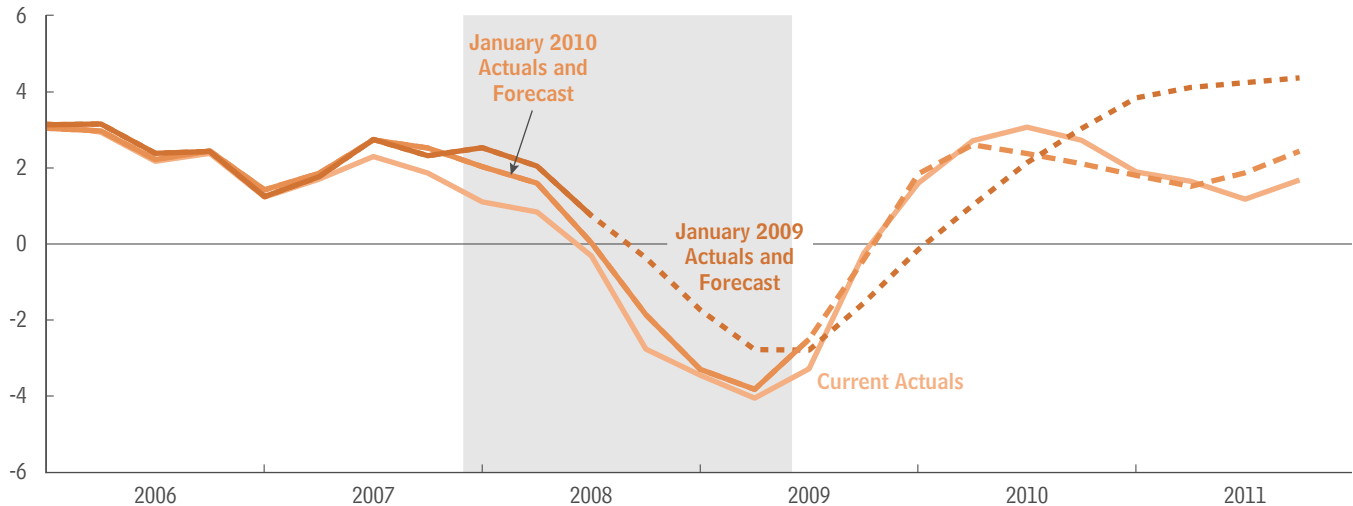
Two-year forecasts of output growth by CBO, the Administration, and the *Blue Chip* consensus have moved

16. See Eugene P. Seskin, "Improved Estimates of the National Income and Product Accounts for 1959–98: Results of the Comprehensive Revision," *Survey of Current Business* (December 1999), pp. 15–43, www.bea.gov/scb/pdf/national/nipa/1999/1299niw.pdf (392 KB).

17. Tables showing the errors of each forecast are available as supplemental material on CBO's website (www.cbo.gov/publication/49891).

Figure 4.**Forecasts by CBO and Revisions to Values for Real Gross Domestic Product**

Percentage Change From the Previous Year



Sources: Congressional Budget Office; Bureau of Economic Analysis.

Notes: Solid lines represent historical data that were available at the time each forecast was conducted. Dashed lines represent forecast data.

Real gross domestic product is the output of the economy adjusted to remove the effects of inflation.

Data are quarterly and are plotted through the fourth quarter of 2011.

closely together over the past 30 years. As measured by the root mean square error, the projected two-year average growth rate of output (both real and nominal) by all three sets of forecasts deviated from the actual growth rate by about 1½ percentage points between 1982 and 2012. In large part, errors in predicting output growth reveal forecasters' difficulty in anticipating business cycle turning points and changing trends in productivity growth.

Growth in Real Output. Forecasting errors over the period from 1976 to 1982 reflected the unusual economic developments of the time:

- Low productivity growth relative to the previous trend,
- High rates of inflation exacerbated by sudden and unexpected movements in crude oil prices, and
- The Federal Reserve's monetary policy, which resisted those inflationary pressures and induced the two recessions that occurred between 1980 and 1982.¹⁸

In the late 1970s, CBO and the Administration, like most forecasters, had expected productivity growth to

move back up to its earlier post–World War II trend, which contributed to overpredictions of the growth in real output. Early in 1980, CBO and the Administration anticipated the coming recession and produced relatively accurate forecasts that year. However, forecasts conducted in the next two years did not anticipate the advent and depth of the 1981–1982 recession, causing overpredictions of the growth in real output (see Figure 5 on page 16).

In 1983 and 1984, economic activity recovered strongly from the 1981–1982 recession, with real output growing faster than expected by CBO, the Administration, and the *Blue Chip* consensus. In forecasts conducted during the 1983–1989 expansion, CBO and the *Blue Chip* consensus underpredicted real output growth by roughly 1 percentage point per year, on average; in the Administration's forecasts, underpredictions were notably smaller, particularly during the latter half of the decade.

18. The credit controls imposed in March 1980 contributed to the severity of the recession in that year. See Stacey L. Schreft, "Credit Controls: 1980," *Economic Review* (Federal Reserve Bank of Richmond, November/December 1990), pp. 25–55.

Table 1.**Summary Measures of Performance for Two-Year Forecasts**

Percentage Points

	CBO	Administration	Blue Chip Consensus ^a
Growth in Real Output (1982–2012) ^b			
Mean error	-0.2	0.1	-0.1
Mean absolute error	1.1	1.2	1.1
Root mean square error	1.4	1.5	1.4
Growth in Nominal Output (1982–2012) ^b			
Mean error	0.1	0.4	0.3
Mean absolute error	1.1	1.2	1.1
Root mean square error	1.4	1.6	1.4
Inflation in the CPI (1982–2012) ^c			
Mean error	0.1	0.1	0.2
Mean absolute error	0.7	0.7	0.7
Root mean square error	0.8	0.9	0.9
Difference Between Inflation in the CPI and in the GDP Price Index (1982–2012) ^{c, d}			
Mean error	-0.1	-0.3	-0.2
Mean absolute error	0.3	0.4	0.4
Root mean square error	0.4	0.6	0.4
Interest Rate on Three-Month Treasury Bills (1982–2012) ^e			
Mean error	0.6	0.3	0.6
Mean absolute error	1.0	1.0	1.0
Root mean square error	1.3	1.3	1.2
Real Interest Rate on Three-Month Treasury Bills (1982–2012) ^{c, e, f}			
Mean error	0.4	0.2	0.4
Mean absolute error	1.0	1.0	1.0
Root mean square error	1.3	1.3	1.2
Interest Rate on 10-Year Treasury Notes (1984–2012) ^g			
Mean error	0.4	0.2	0.5
Mean absolute error	0.7	0.8	0.7
Root mean square error	0.7	0.9	0.8
Growth in Wages and Salaries (1980–2012)			
Mean error	0.5	0.7	n.a.
Mean absolute error	1.4	1.5	n.a.
Root mean square error	1.9	2.1	n.a.
Change in Wages and Salaries as a Share of Output (1980–2012)			
Mean error	0.3	0.2	n.a.
Mean absolute error	0.8	0.8	n.a.
Root mean square error	0.9	0.9	n.a.

Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*.

Notes: The mean error is the arithmetic average of the forecasting errors. The mean absolute error is the arithmetic average of the forecasting errors without regard to sign. The root mean square error is calculated by first squaring the errors and then taking the square root of the arithmetic average of the squared errors. Errors are forecast values minus actual values; therefore, a positive error is an overestimate.

To compare forecast and actual data, annual averages were computed for growth rates, inflation rates, interest rates, and wages and salaries as a share of output.

CPI = consumer price index; CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product; GNP = gross national product; n.a. = not applicable (the *Blue Chip* consensus does not report forecasts of wages and salaries).

- The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.
- Output is either GDP or GNP. GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward. Real output is nominal output adjusted to remove the effects of inflation.
- Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.
- The GNP price index was forecast before 1992; the GDP price index was forecast from 1992 onward.
- In most years, the secondary-market interest rate was forecast. However, the rate on newly issued bills was forecast by the Administration through 2000 and by the *Blue Chip* consensus from 1982 to 1985 and from 1992 to 1997.
- The real interest rate is the nominal interest rate deflated by growth in the consumer price index.
- Forecasts of the Moody's Aaa corporate bond rate were used for the years in which the interest rate on 10-year Treasury notes was not forecast: 1984 and 1985 for CBO's forecasts and 1984 through 1995 for the *Blue Chip* consensus forecasts.

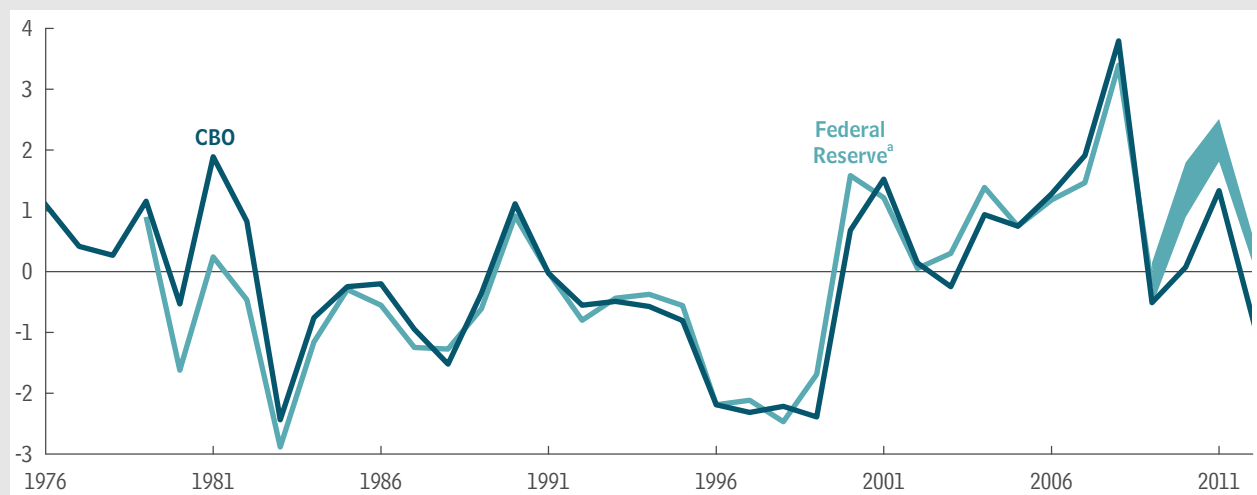
Box 1.**Comparison of Two-Year Forecasts by CBO and the Federal Reserve**

Like those by the Administration and the *Blue Chip* consensus, forecasts by the Federal Reserve provide an informative point of comparison when evaluating the Congressional Budget Office's forecasts. The Federal Reserve does not immediately release its two-year forecasts of interest rates or of wages and salaries, and it does not publish five-year forecasts. Therefore, CBO's principal analysis for this report did not include the Federal Reserve's forecasts. However, the Federal Reserve has published timely two-year forecasts of real (inflation-adjusted) output growth and inflation rates, allowing for a comparison of forecasts of those variables.

CBO and the Federal Reserve have had largely similar forecasts of the growth of real output over two-year periods (see the figure below). Notable divergences occurred during the early 1980s, in 2010, and in 2012. Before the 1980 recession, CBO produced a fairly accurate forecast of real output growth, and the Federal Reserve overestimated the depth of the coming recession. However, in early 1981 and 1982, CBO did not anticipate the advent or depth of the 1981–1982 recession, whereas the Federal Reserve accurately forecast the downturn and subsequent recovery. In 2010, CBO's forecast correctly anticipated a continued slow economic

Errors in Forecasting the Growth of Real Output

Percentage Points



Sources: Congressional Budget Office; Federal Reserve; Bureau of Economic Analysis (BEA).

Notes: Errors are shown for forecasts of the average annual growth rate of real output over two-year periods. Errors are forecast values minus actual values; therefore, a positive error is an overestimate. Errors are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Real (inflation-adjusted) output is either real gross domestic product (GDP) or real gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

From 2009 onward, growth rates are measured on a fourth-quarter to fourth-quarter basis.

Data are annual and are plotted through 2012. Data for the Federal Reserve are plotted beginning in 1979.

- a. Before 2009, forecasts were prepared by the staff of the Board of Governors of the Federal Reserve System. Between 2009 and 2012, the shaded area encompasses the central tendency of Federal Reserve forecasts. The central tendency reflects the forecasts of the members of the Board of Governors and the presidents of the Federal Reserve Banks without the three highest and three lowest forecasts.

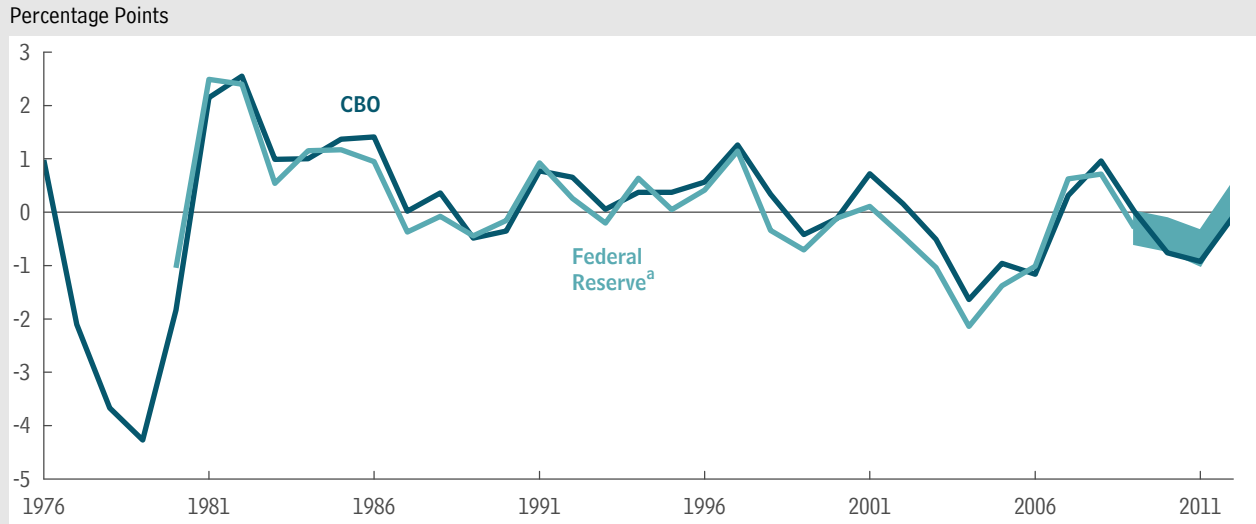
Continued

Box 1.

Continued

Comparison of Two-Year Forecasts by CBO and the Federal Reserve

Errors in Forecasting Consumer Price Inflation



Sources: Congressional Budget Office; Federal Reserve; Bureau of Labor Statistics; and Bureau of Economic Analysis (BEA).

Notes: Errors are shown for forecasts of the average annual growth rate of consumer prices over two-year periods. Errors are forecast values minus actual values; therefore, a positive error is an overestimate. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Before 2009, the consumer price index (CPI) was forecast. For most years, the CPI for all urban consumers was forecast. However, the CPI for urban wage earners and clerical workers was forecast by CBO from 1976 through 1978 and from 1986 through 1989. From 2009 onward, the price index for personal consumption expenditures was forecast, and errors are based on the most recent data reported by BEA.

From 2009 onward, growth rates are measured on a fourth-quarter to fourth-quarter basis.

Data are annual and are plotted through 2012. Data for the Federal Reserve are plotted beginning in 1980.

a. Before 2009, forecasts were prepared by the staff of the Board of Governors of the Federal Reserve System. Between 2009 and 2012, the shaded area encompasses the central tendency of Federal Reserve forecasts. The central tendency reflects the forecasts of the members of the Board of Governors and the presidents of the Federal Reserve Banks without the three highest and three lowest forecasts.

recovery following the 2007–2009 recession, but that forecast assumed additional fiscal restraint from expiring tax provisions that were subsequently extended.¹ In contrast, the central tendency of the Federal Reserve’s forecasts considerably over-predicted growth. In 2012, CBO’s underprediction of output growth in part reflects the extension of certain expiring tax provisions, which significantly reduced the amount of fiscal restraint compared with

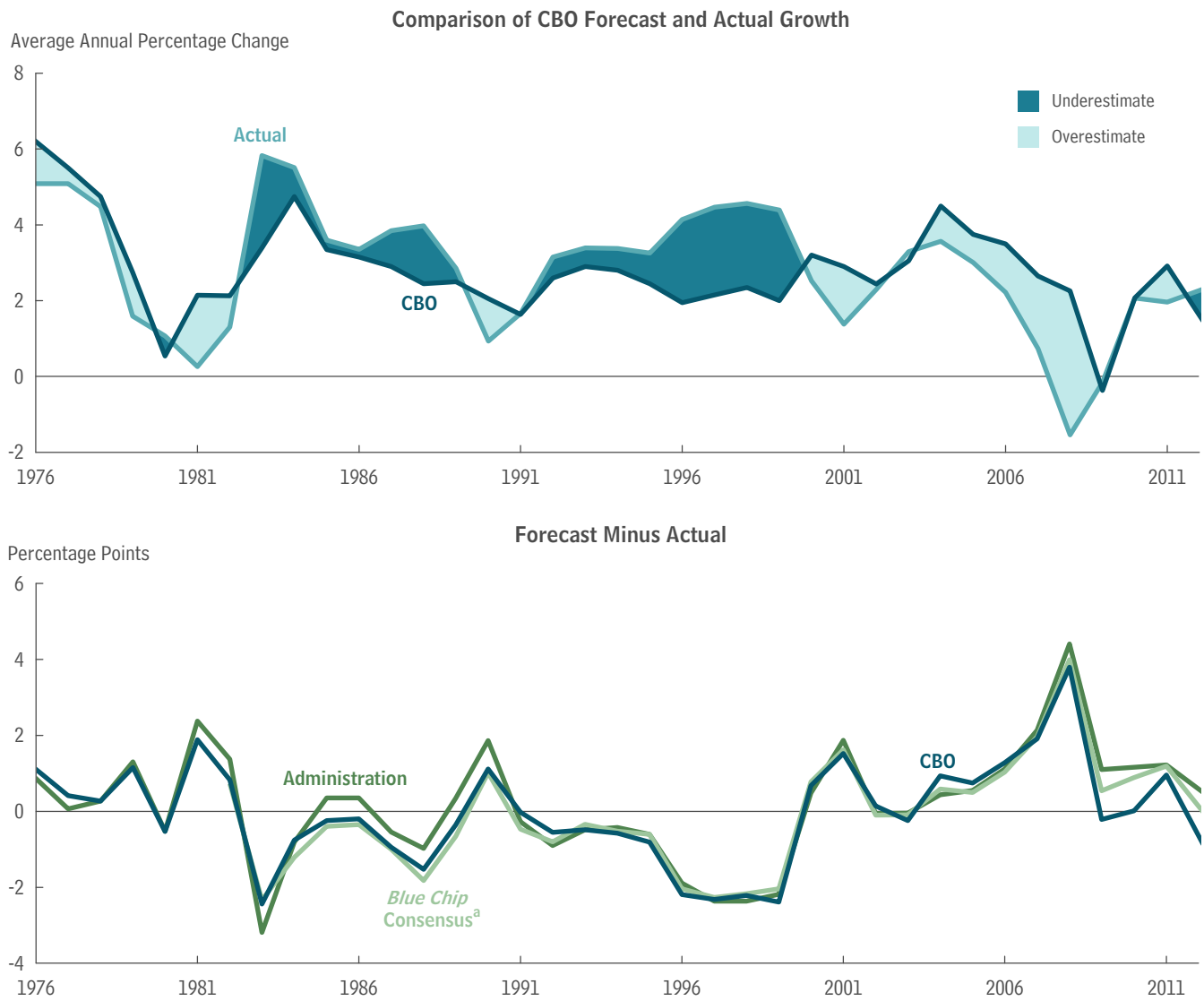
what had been embodied in CBO’s current-law projection. By comparison, the Federal Reserve overpredicted growth in 2012.

In general, CBO and the Federal Reserve also had similar forecasts of inflation (see the figure above). Forecasts conducted between 2001 and 2005, however, represent an exception. In early 2001, CBO’s forecast overpredicted growth in consumer prices, largely because of the unexpected 2001 recession, while the Federal Reserve’s expectations showed little error. Between 2003 and 2005, both forecasters underpredicted inflation rates, but the errors by the Federal Reserve were somewhat larger.

1. In early 2010, current law included the scheduled expiration of several tax provisions at the end of December 2010. Most of those provisions were originally enacted in the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003.

Figure 5.

Growth in Real Output: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the average annual growth rate of real output over two-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Real (inflation-adjusted) output is either real gross domestic product (GDP) or real gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. Real GNP was forecast before 1992; real GDP was forecast from 1992 onward.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

The unexpected 1990–1991 recession resulted in overpredictions of real output growth in 1990. Even so, the errors by CBO and the *Blue Chip* consensus that year were actually smaller than the root mean square error for the 1982–2012 period. In contrast, the error by the Administration that year was considerably larger than its root mean square error for the whole period.

In every year between 1992 and 1999, all of the forecasts underpredicted two-year growth in real output, with very large errors made between 1996 and 1999. About one-fourth of the extent of those errors resulted from subsequent revisions that BEA made to the national income and product accounts (NIPAs), which included important definitional changes. Those data revisions aside, the significant underpredictions made between 1996 and 1999 reflect several important economic developments that analysts did not anticipate—in particular, the investment boom of the late 1990s, which increased the capital stock and thereby boosted labor productivity and real output more than many forecasters had expected.

Forecasts conducted in 2001 did not anticipate the relatively mild recession in that year. As a result, CBO and the *Blue Chip* consensus overpredicted real output growth by about 1.5 percentage points, and the Administration overpredicted growth by almost 2 percentage points. Following the recession, economic activity underwent an unusually slow recovery and weak expansion. During that time, productivity continued to grow at the strong post-1995 rate while labor hours grew very little.

In forecasts conducted between 2004 and 2006, expectations for real output growth proved to be too optimistic; however, errors by the Administration and the *Blue Chip* consensus were slightly smaller than those by CBO. Perhaps contributing to the overpredictions, rising energy prices (unanticipated by many forecasters) dampened growth in real GDP by roughly a quarter of a percentage point in 2004, less than half of a percentage point in 2005, and about a quarter of a percentage point during the first half of 2006.¹⁹

Forecasts conducted in 2007 and 2008 failed to anticipate the growing imbalances in the housing and financial

markets. During the early 2000s, real output growth was partly supported by a boom in residential construction, which was fueled by a growing bubble in house prices. By 2007, a downturn in the housing market was apparent, and tensions in financial markets began to emerge. Despite those tensions, forecasts conducted in early 2008 assumed that a recession would be avoided. For example, in January 2008, CBO reported, “If a severe credit crunch did occur, it would drive the economy into recession by significantly curbing financial activity and consumer spending. However, CBO assumes in its forecast that the Federal Reserve will implement policies to prevent such a crunch and that the financial sector is capable of absorbing most of the losses it faces.”²⁰ Those assumptions did not hold true: In 2008, forecasts by CBO, the Administration, and the *Blue Chip* consensus overpredicted real output growth by at least 3¾ percentage points.

Between 2009 and 2012, CBO, the Administration, and the *Blue Chip* consensus all wrestled with uncertainty about underlying economic conditions and about future federal fiscal policy.

In 2009 and 2010, CBO produced relatively accurate forecasts of the economic recovery. Compared to CBO, the Administration and the *Blue Chip* consensus expected a faster economic recovery and overpredicted real output growth in their 2009 and 2010 forecasts. One source of divergence between CBO's forecasts and the other forecasts during those years was differences in fiscal policy assumptions. In early 2009, participants in the *Blue Chip* consensus reported that they expected additional fiscal stimulus, which implied stronger output growth than under then-current law.²¹ In early 2010, CBO's forecast assumed additional fiscal restraint from expiring tax provisions that were subsequently extended.²²

20. See Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2008 to 2018* (January 2008), p. 23, www.cbo.gov/publication/41661.

21. See Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2009 to 2019* (January 2009), pp. 10–11, www.cbo.gov/publication/41753.

22. In early 2010, current law included the scheduled expiration of several tax provisions at the end of December 2010. Most of those provisions were originally enacted in the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003.

19. See Congressional Budget Office, *The Economic Effects of Recent Increases in Energy Prices* (July 2006), p. 6, www.cbo.gov/publication/17984.

CBO's forecast errors in 2011 and 2012 were notable and divergent, with an overprediction in 2011 and an underprediction in 2012. CBO's underprediction of output growth in 2012 in part reflects the extension of certain expiring tax provisions, which significantly reduced the amount of fiscal restraint that had been embodied in CBO's current-law projection. By comparison, the Administration and the *Blue Chip* consensus overpredicted growth in both 2011 and 2012.

Growth in Nominal Output. Differences in forecasting errors between real and nominal output growth indicate inaccuracies in projections of inflation in the GDP price index.²³ (For information about the difference between the GDP price index and the consumer price index, or CPI, see the section "Inflation" below.) During the 1980s and 1990s, CBO, the Administration, and the *Blue Chip* consensus tended to overpredict inflation, which partially offset underpredictions of real output growth. Consequently, forecasts of nominal output growth appear to have less bias over that period than do forecasts of real output growth.

During much of the 2000s, CBO, the Administration, and the *Blue Chip* consensus tended to underpredict inflation rates, which generally offset overpredictions of real output growth. However, forecasts conducted in 2008 provided a notable exception. Early that year, all three sets of forecasts reflected the assumption that the economy would avoid a recession and therefore overpredicted both inflation and real output growth. As a result, forecasts conducted in that year overpredicted nominal output growth by about 4 to 5 percentage points (see Figure 6).

Inflation

The errors in inflation forecasts generally have reflected turbulence in crude oil prices and variation in the state of the economy. For example, rapidly rising oil prices contributed to forecasters' sizable underpredictions of inflation during the late 1970s and mid-2000s. During the early 1980s, the deep recession dramatically and unexpectedly reduced the rate of inflation, but forecasters only gradually recognized the extent of that reduction and consequently made large overpredictions of price growth during much of the decade.

23. Gross national product and its price index were forecast by CBO, the Administration, and the *Blue Chip* consensus before 1992; GDP and its price index were forecast from 1992 onward.

The evaluation focuses on two measures of inflation that are important for projecting federal outlays and revenues. One is the consumer price index, which measures inflation in the prices of a fixed group of consumer goods and services.²⁴ Forecasts of federal outlays depend, in part, on expected inflation in that index. For example, the CPI is used to annually adjust payments to Social Security beneficiaries. Federal revenues also depend on inflation in consumer prices because elements of the individual income tax, such as tax brackets, have been indexed to the CPI since the mid-1980s. All else being equal, higher inflation in the CPI implies faster growth in outlays and slower growth in revenues.

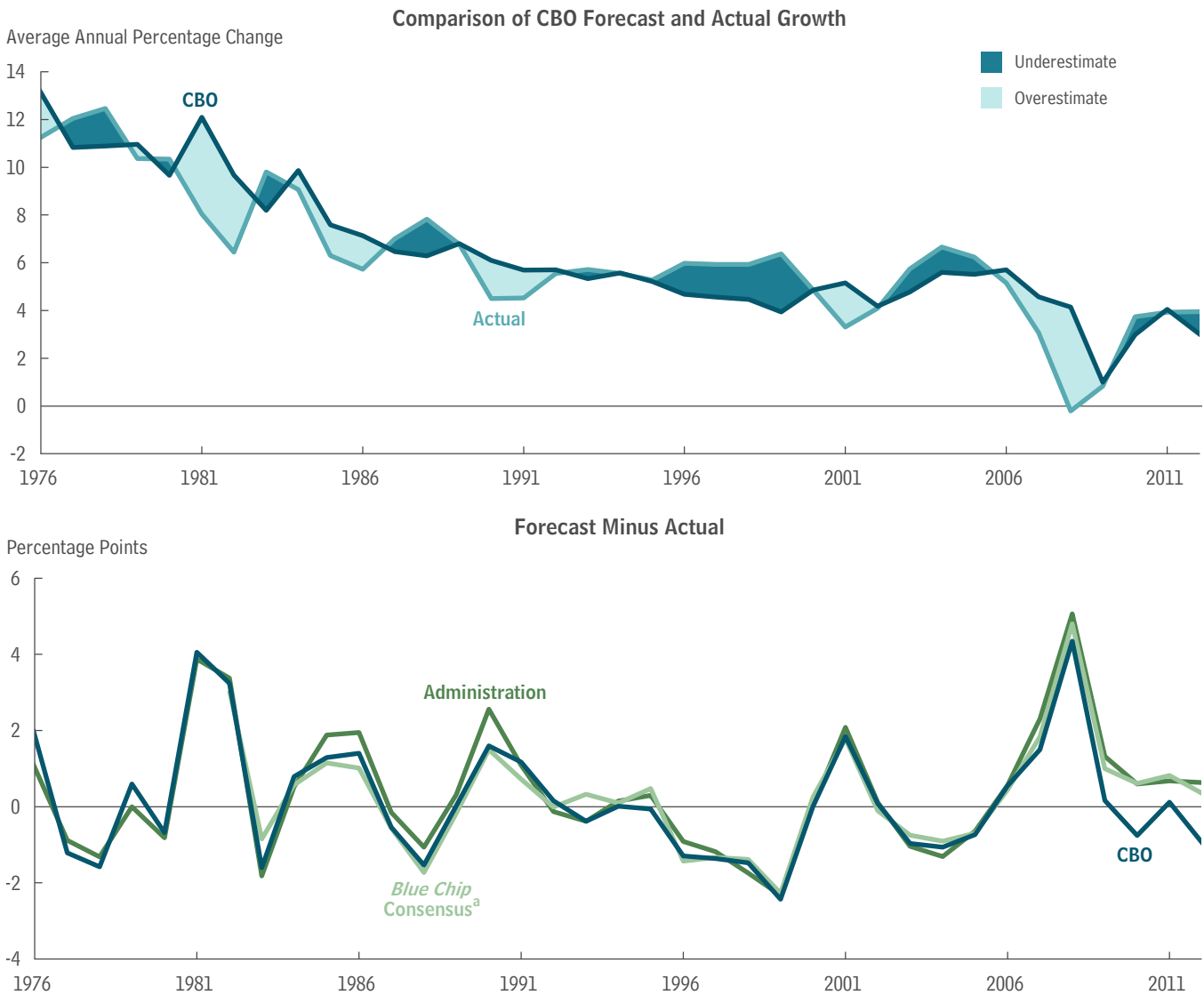
The second measure is the difference between the rate of inflation in the CPI and the rate of inflation in the price index for GDP. The GDP price index is a summary measure of the prices of all goods and services that make up gross domestic product. Its growth is a critical determinant in forecasting the growth of nominal GDP and, therefore, the growth of income subject to federal taxes. All else being equal, higher inflation in the GDP price index implies faster growth in revenues. Consequently, if the GDP price index was forecast to grow more slowly than the CPI, the projected deficit would be larger than if the reverse was forecast.

Inflation in the CPI. During the late 1970s, CBO and the Administration made similarly large errors in forecasts of CPI inflation (see Figure 7). Primarily because of the spike in crude oil prices in 1979 and 1980, forecasts conducted in 1978 and 1979 underpredicted inflation by about 4 percentage points, on average.

In forecasts conducted between 1982 and 1986, CBO, the Administration, and the *Blue Chip* consensus overpredicted inflation in the CPI by about 1½ percentage points, on average. That tendency largely stemmed from the fact that the 1981–1982 recession led to an unanticipated sharp and lasting reduction in the rate of inflation.

24. In most years, the inflation forecasts are for the CPI-U, which measures inflation in the prices paid by all urban consumers. In the period from 1976 to 1978 and from 1986 to 1989, CBO forecast the CPI-W, which measures inflation in the prices paid by urban wage earners and clerical workers, while the Administration forecast the CPI-W through 1991. For the purpose of evaluating forecasts, the distinction between the two measures was consequential mainly in 1984, when inflation in the CPI-U and CPI-W diverged by 0.9 percentage points.

Figure 6.
Growth in Nominal Output: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the average annual growth rate of nominal output over two-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

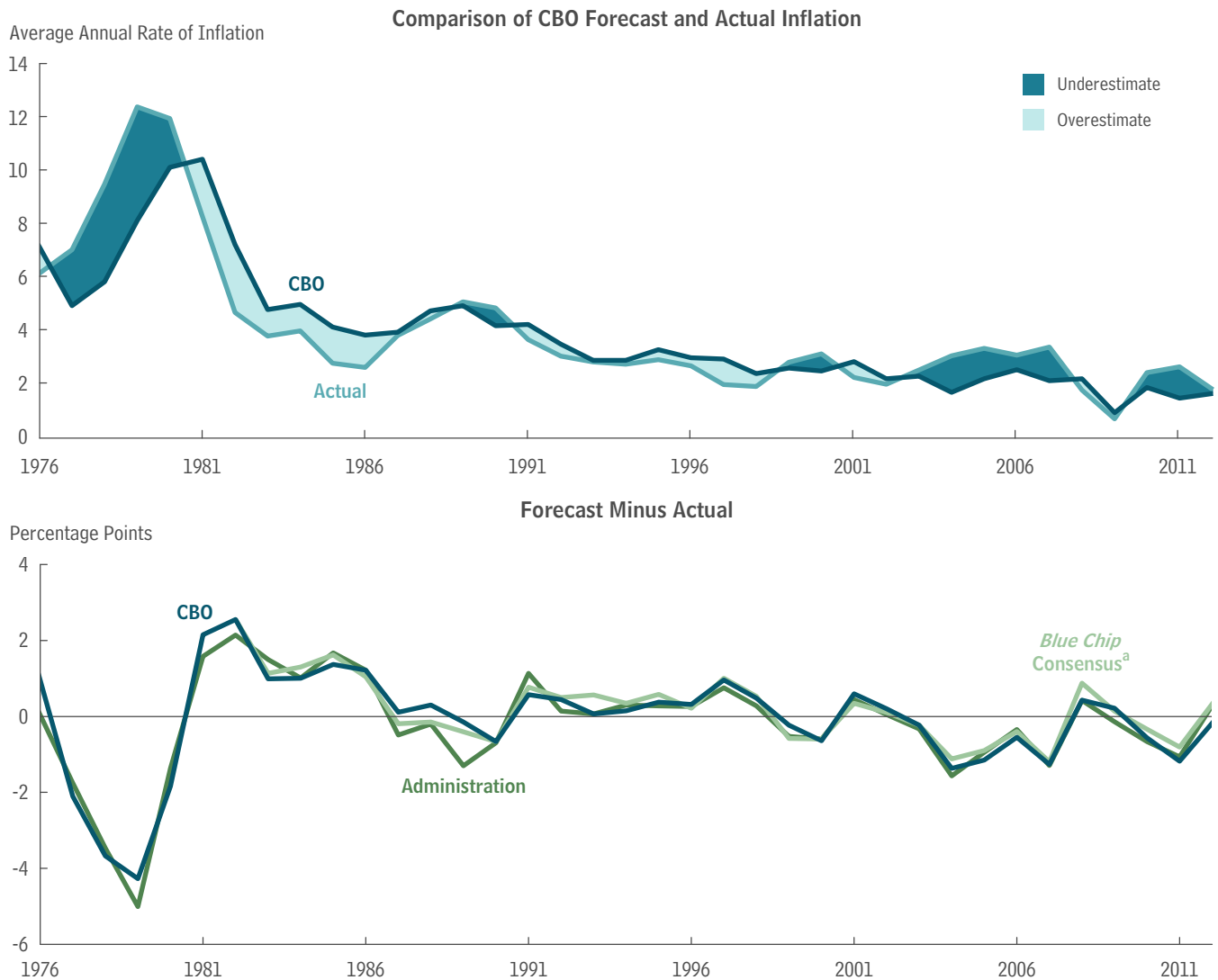
Nominal output is either gross domestic product (GDP) or gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

Figure 7.

Inflation in the Consumer Price Index: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Labor Statistics (BLS).

Notes: Actual and forecast data show the average annual growth rate of the consumer price index over two-year periods. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

Also, the forecasters did not expect the drop in crude oil prices that occurred in early 1986.

Between 1987 and 2003, CBO, the Administration, and the *Blue Chip* consensus made relatively small errors in forecasts of inflation in the CPI, with a root mean square error of roughly one-half of a percentage point. Inflation forecasts probably benefited from the relatively benign economic environment during most of that period, in contrast to the turbulence of the late 1970s and early 1980s. Growth in the CPI in that period remained within a narrow range, particularly after 1990. Nevertheless, unexpected swings in energy prices and lower inflationary pressures from the 2001 recession led to forecasting errors between 1999 and 2001 that were generally among the larger errors for the 1987–2003 period.

Between 2004 and 2007, the forecasts persistently underpredicted inflation in the CPI largely because of the unexpected rise in crude oil prices. The predictions of two-year inflation rates were about 1 percentage point below actual inflation rates, on average.

In 2008, CBO, the Administration, and the *Blue Chip* consensus did not anticipate the 2007–2009 recession and the downward pressure that the recession would place on consumer price growth. As a result, CBO and the Administration overpredicted inflation slightly, as did the *Blue Chip* consensus but to a greater extent.

The 2009 projections by all of the forecasters showed a decline in inflation close to what actually occurred, but the projections between 2010 and 2012 generally underpredicted inflation. The largest errors, in 2010 and 2011, reflect the unexpected increase in the price of energy in those years.

Difference Between Inflation Measures. For forecasts conducted between 1978 and 1980, CBO and the Administration underpredicted the difference in inflation measures by more than 2 percentage points, on average (see Figure 8). In 1979 and 1980, the difference between inflation in the CPI and the gross national product (GNP) price index spiked to levels unprecedented since the end of World War II. A significant part of the divergence can be explained by the oil price shock; a surge in oil prices has a larger effect on the CPI than on the GNP price index because petroleum products represent a much larger share of the goods and services consumed in this country than of the goods and services produced. Even

so, the gap between the two inflation measures was unusually wide with the effect of energy prices removed.

In forecasts conducted through early 1999, the tendency to underpredict the difference between the inflation measures largely reflected the methodological change to the national income and product accounts that year, when BEA added business and government purchases of software to investment and, therefore, to GDP. Because the price index for software purchases grew much less rapidly than other prices, on average, the change in the classification of software spending caused a downward revision of the historical data for the growth of the GDP price index. Hence, the forecasts made before 2000 were based on a pattern of historical growth in the GDP price index that was higher than is currently reported. That difference probably accounted for about 0.2 percentage points—or two-thirds—of the apparent bias in forecasts for that period.

Forecasts in 2000 were very accurate, but those between 2001 and 2006 typically overestimated the difference in the inflation measures. The forecasts missed the large declines in the difference in 2001 and 2002 that resulted from the lower inflation in energy prices and lower inflationary pressures from the 2001 recession. Those two developments led to a larger decline in the rate of CPI inflation than in the rate of inflation measured by the GDP price index through 2002. Both inflation measures increased after 2002, but their difference did not rise as it generally had following past recessions, so forecasts conducted between 2003 and 2006 mostly overestimated the difference between inflation measures.

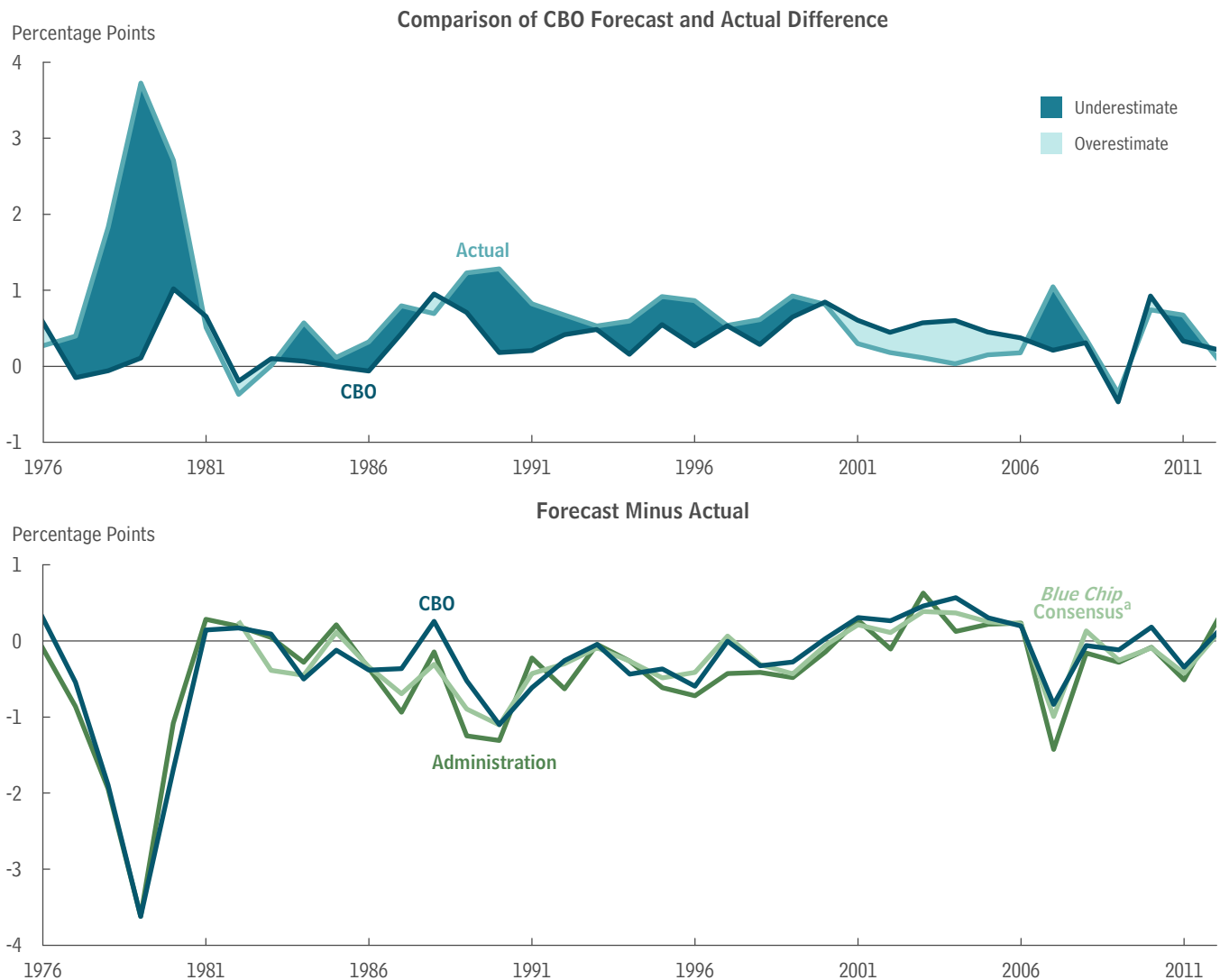
The sharp increase in the difference between the inflation measures in 2008 caught CBO, the Administration, and the *Blue Chip* consensus by surprise, raising the errors in the 2007 forecasts to their largest absolute values since 1990. From 2009 onward, the difference between the inflation measures was smaller, and the Administration and the *Blue Chip* consensus tended to underestimate it by a moderate amount.

Interest Rates

On average, between 1982 and 2012, CBO, the Administration, and the *Blue Chip* consensus overpredicted interest rates. Forecasts by the Administration were less biased over the period because large negative forecasting errors in the late 1980s partly offset positive errors during other periods (particularly the 2000s). Notably, all of

Figure 8.

Difference Between Inflation in the CPI and in the GDP Price Index: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Labor Statistics (BLS); Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the difference between average annual inflation measures (the CPI minus the GDP price index) over two-year periods. Actual values for the GDP price index are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.

The gross national product price index was forecast before 1992; the GDP price index was forecast from 1992 onward.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

CPI = consumer price index; CPI-U = consumer price index for all urban consumers;
 CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

the forecasts made after the 1990–1991, 2001, and 2007–2009 recessions underestimated the duration of the easing of monetary policy, which largely accounts for the tendency to overpredict interest rates.

CBO forecasts interest rates on Treasury securities to project payments on the federal debt and other components of the budget. Those forecasts focus on two key rates—the rate on 3-month Treasury bills and that on 10-year Treasury notes. All else being equal, higher interest rates result in larger interest payments and faster growth in federal debt held by the public. Forecasts of interest rates depend on a variety of factors, which include:

- *Monetary policy.* During periods of low inflation and high unemployment, for example, the Federal Reserve attempts to stimulate demand by lowering short-term interest rates, which in turn can lower the cost of borrowing over longer periods of time.
- *Inflation.* Expectations of inflation are embedded in interest rates. Interest rates generally rise, for example, when participants in financial markets expect a higher rate of inflation in the future. Moreover, the Federal Reserve has responded to increasing inflationary pressures by taking actions to raise interest rates.
- *The issuance of federal debt securities.* The federal government issues Treasury securities to finance budget deficits. All else being equal, an increase in the supply of those securities would tend to increase interest rates.
- *Turmoil in the financial system.* In periods when investors have been increasingly concerned about the safety of their investments, they have sought to hold more U.S. Treasury securities. Such an increase in demand lowers interest rates on those securities.

CBO has evaluated forecasts of the interest rate on three-month Treasury bills in both nominal and real terms. The nominal rate of interest is the rate quoted in the secondary market.²⁵ The real interest rate used here is the

25. The rate on newly issued bills was forecast by the Administration through 2000 and by the *Blue Chip* consensus from 1982 to 1985 and from 1992 to 1997.

nominal rate deflated by the predicted growth in the consumer price index.

Interest Rate on Three-Month Treasury Bills. In 1978 and 1979, both CBO and the Administration underpredicted the two-year average nominal interest rate on three-month Treasury bills by about 2½ percentage points, on average (see Figure 9). That tendency stemmed from underpredicting inflation rates during that period. In fact, CBO and the Administration overpredicted real interest rates by more than 1¼ percentage points, on average, in those years (see Figure 10). Those overpredictions may have stemmed from the agencies' overly optimistic forecasts of real output growth during the period.

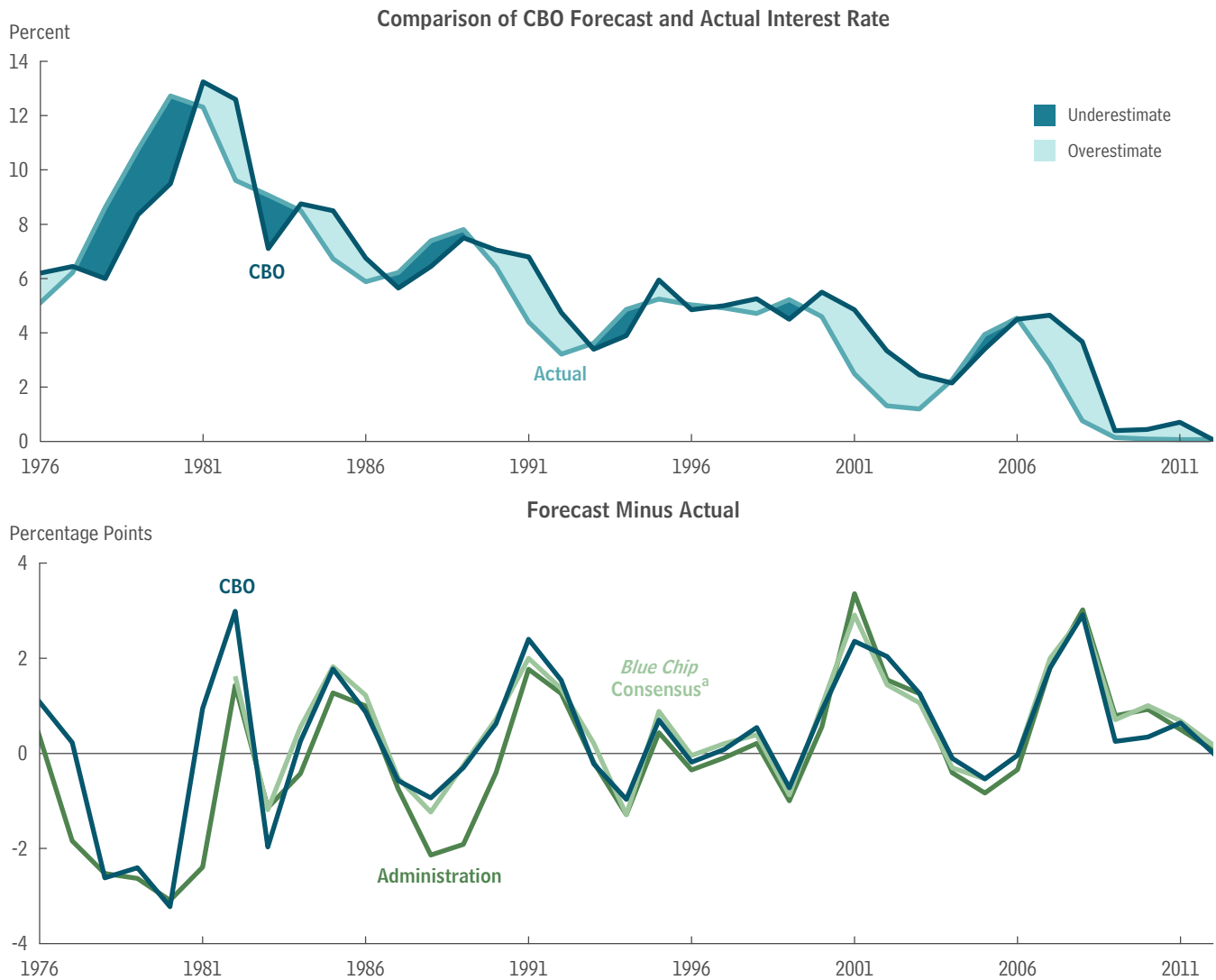
During the early 1980s, actions by the Federal Reserve raised interest rates, which contributed to two consecutive recessions and ultimately a sharp and lasting cut in the rate of inflation. In 1980 and 1981, many forecasters did not fully anticipate that prolonged period of restraint in monetary policy or its impact on price growth. In 1980, CBO and the Administration underpredicted both nominal and real interest rates, suggesting that monetary policy proved tighter than expected over the following two years. In 1981, CBO's forecast overpredicted nominal interest rates but underpredicted real interest rates, reflecting an overprediction of inflation; the Administration's forecast underpredicted both nominal and real interest rates.

Between 1982 and 2012, forecasts of nominal interest rates on three-month Treasury bills displayed notable upward bias. On average, forecasts by CBO and the *Blue Chip* consensus overpredicted nominal interest rates by 0.6 percentage points, and the Administration overpredicted nominal interest rates by 0.3 percentage points. In part, that bias stemmed from forecasters' tendency to overpredict inflation rates between 1982 and 1998. Forecasters' difficulty in anticipating business cycle turning points also accounts for overpredictions of interest rates around the 1990–1991, 2001, and 2007–2009 recessions.

Since 1990, forecasts made after recessions have tended to underestimate the duration of the easing of monetary policy. For example, forecasts conducted in early 1991 and 1992 expected interest rates to begin rising as the economy recovered from the 1990–1991 recession. The

Figure 9.

Interest Rate on Three-Month Treasury Bills: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Federal Reserve; Bureau of the Public Debt.

Notes: Actual and forecast data show the geometric average of the interest rate over two-year periods. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

In most years, the secondary-market interest rate was forecast. However, the rate on newly issued bills was forecast by the Administration through 2000 and by the *Blue Chip* consensus from 1982 to 1985 and from 1992 to 1997.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

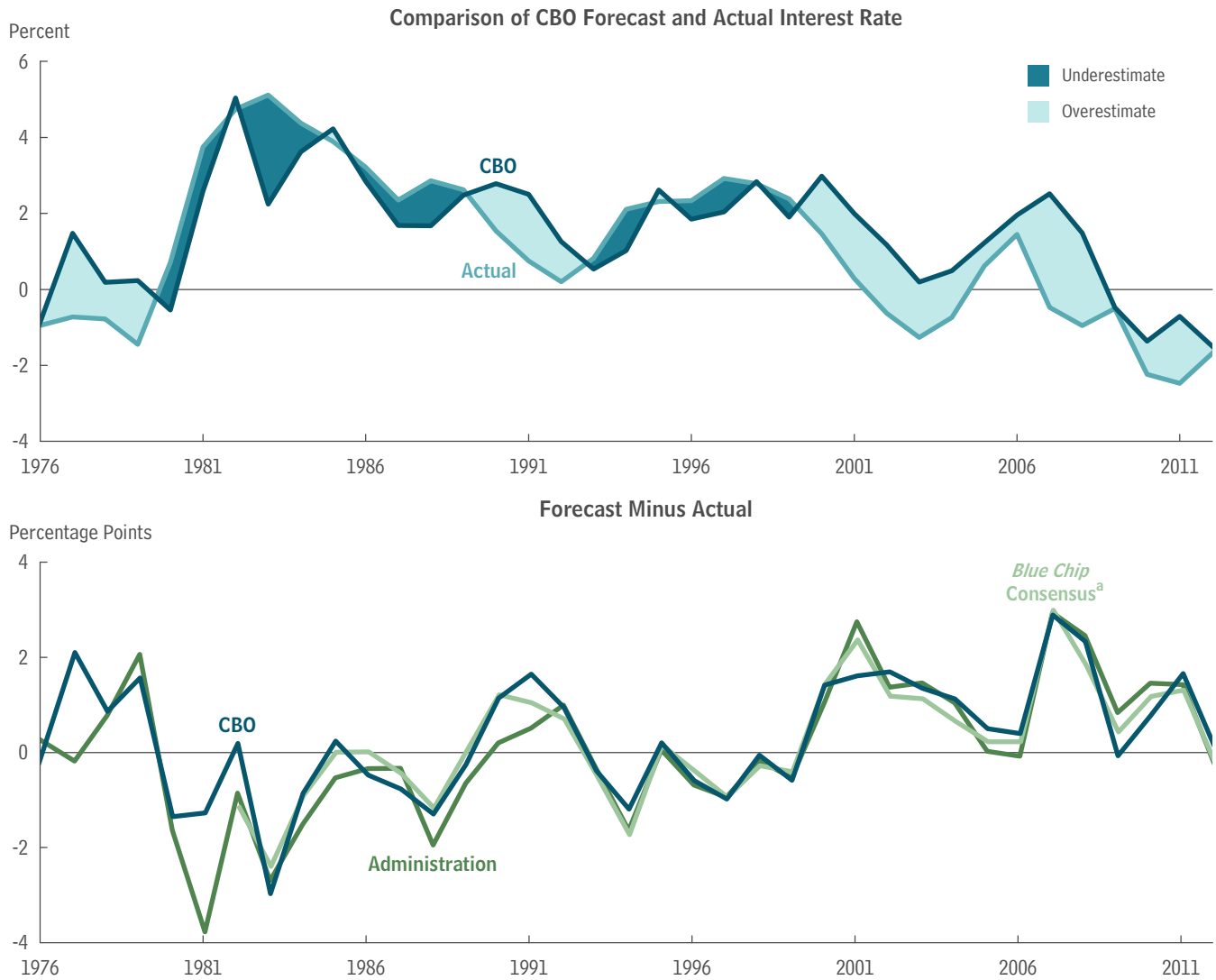
a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

recovery, however, was unexpectedly weak, and inflation remained low. That led the Federal Reserve to continue to ease monetary policy for several years, pushing down the nominal interest rate on three-month Treasury bills from nearly 8 percent in the first half of 1990 to 3 percent in 1993.

In forecasts conducted during the 2000–2012 period, CBO, the Administration, and the *Blue Chip* consensus overpredicted real interest rates by about 1¼ percentage points, on average. Much of that bias can be attributed to the 2001 and 2007–2009 recessions and to the surprisingly sluggish recoveries in economic activity following those downturns. Indeed, despite the Federal Reserve’s

Figure 10.

Real Interest Rate on Three-Month Treasury Bills: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Labor Statistics (BLS); Federal Reserve; Bureau of the Public Debt.

Notes: Actual and forecast data show the geometric average of the nominal interest rate deflated by the predicted growth in the consumer price index over two-year periods. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

In most years, the secondary-market interest rate was forecast. However, the rate on newly issued bills was forecast by the Administration through 2000 and by the *Blue Chip* consensus from 1982 to 1985 and from 1992 to 1997.

Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.

Data are annual and are plotted through 2012. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

prolonged easing of monetary policy following the 2001 recession, real output growth during the mid-2000s remained weaker than expected.

Interest Rate on 10-Year Treasury Notes. Between 1984 and 2012, CBO overpredicted the nominal interest rate on 10-year Treasury notes by 0.4 percentage points, on average, while *Blue Chip* overpredicted it by 0.5 percentage points, on average (see Figure 11).²⁶ Forecasts by the Administration were less biased (overpredicting the rate by 0.2 percentage points, on average) because large negative forecasting errors in the late 1980s and early 1990s offset positive errors during other periods, particularly the 2000s. As measured by the root mean square error, forecasts by CBO deviated from actual interest rates by about 0.7 percentage points, on average; forecasts by the *Blue Chip* consensus deviated from actual interest rates by about 0.8 percentage points, on average; and forecasts by the Administration deviated from actual interest rates by about 0.9 percentage points, on average.

Between 2000 and 2008, CBO, the Administration, and the *Blue Chip* consensus persistently overpredicted the nominal interest rate on 10-year Treasury notes (by 0.7 percentage points, on average). To some extent, the 2001 and 2007–2009 recessions explain overpredictions in forecasts conducted before and during those downturns. To some extent, optimistic forecasts of real output growth probably account for overpredictions during the expansionary period of the mid-2000s. Given that outlook for faster growth in the economy, forecasters probably expected the Federal Reserve to try to temper that growth and the inflationary pressures that could have resulted from it.

By early 2009, forecasters had revised their expectations for interest rates downward. For that reason, forecasts of the rate for 10-year Treasury notes in 2009 were relatively accurate, deviating from actual interest rates by less than one-quarter of a percentage point.

In early 2010, long-term interest rates were expected to rise, on average, during the economic recovery, but rates continued to decline over the next two years (particularly in 2011). From 2010 to 2012, CBO's forecast

26. For simplicity of exposition, this evaluation refers to 10-year Treasury notes. However, forecasts of the Moody's Aaa corporate bond rate were used in years when forecasts of 10-year Treasury notes were not made. Those years are 1984 and 1985 for CBO's forecasts and 1984 through 1995 for the *Blue Chip* consensus forecasts.

overpredicted the 10-year Treasury note rate by 0.8 percentage points, on average; forecasts by the Administration and the *Blue Chip* consensus overpredicted that rate, on average, by 1.1 percentage points.

Wages and Salaries

Particularly since 2001, CBO and the Administration have tended to overpredict growth in wages and salaries and the change in wages and salaries as a percentage of GDP.²⁷ (Because the *Blue Chip* consensus does not report forecasts of wages and salaries, the evaluation here discusses only forecasts conducted by CBO and the Administration.) To some extent, the fact that forecasters did not anticipate the 2001 and 2007–2009 recessions accounted for that tendency. However, both agencies also were surprised by the unusually sluggish recovery in wages and salaries relative to output following the two recessions.

Projections of federal revenues importantly depend on forecasts of wages and salaries, which are a major component of taxable income.²⁸ Errors in forecasts of wages and salaries may result from inaccurate forecasts of various items:

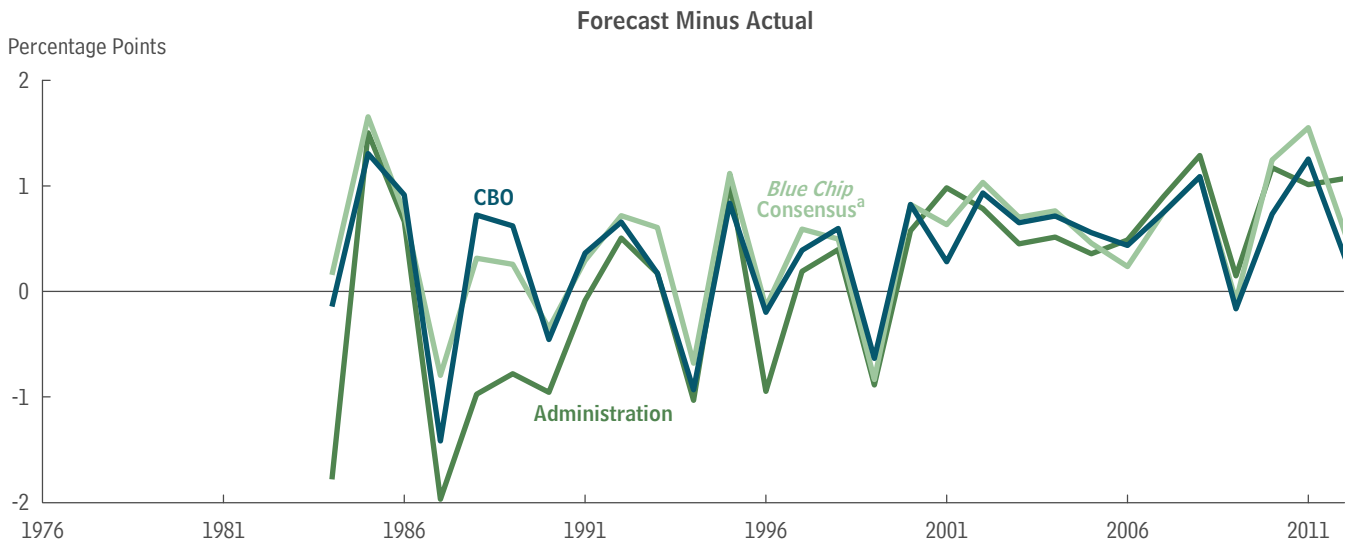
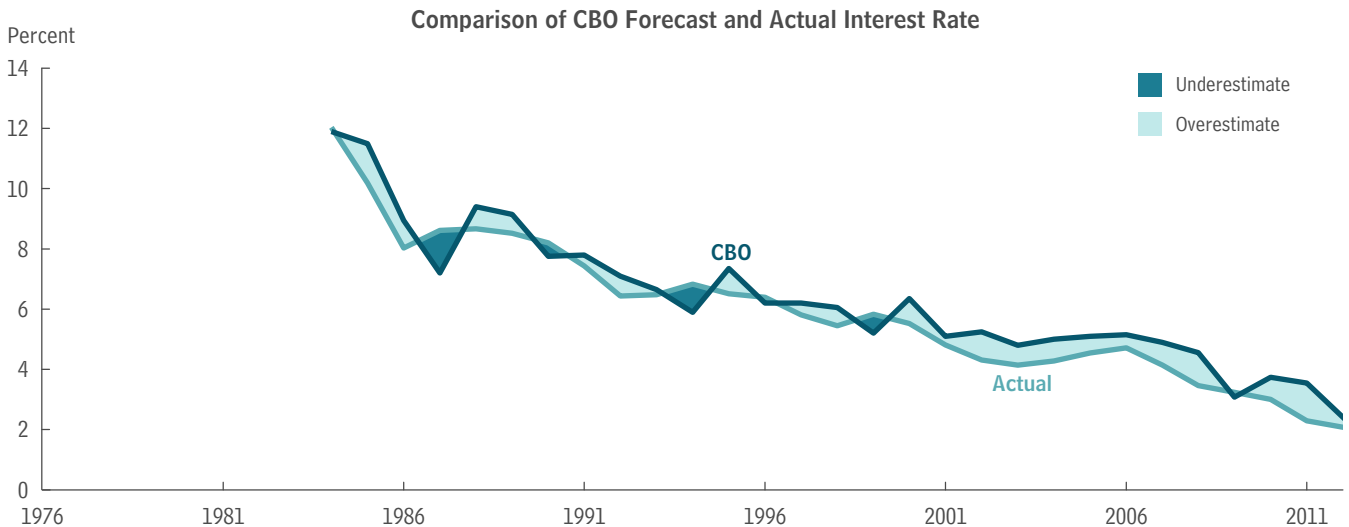
- *Gross domestic product.* Wages and salaries generally grow with overall economic activity and inflation. A forecast that fails to anticipate a downturn in output growth would probably overpredict growth in wages and salaries as well.
- *The statistical discrepancy between GDP and gross domestic income (GDI, the income earned in the production of GDP).* In principle, GDP and GDI should be equal, but in practice, they differ because BEA uses different primary sources to estimate product on the one hand and income on the other. To predict GDI, forecasters must also project the statistical discrepancy, which is difficult because the discrepancy stems from imperfect data collection and estimation processes. Unexpected swings in the discrepancy may raise or lower wages and salaries relative to GDP.

27. Reported data refer to wage and salary disbursements rather than accruals.

28. In some earlier editions of this report, CBO included an analysis of its forecast of the sum of wages and salaries and corporate book profits. That sum has been dropped from the analysis because legislative changes to the tax rules affecting corporations can affect book profits and have increasingly done so, which makes it difficult to identify the economic forecasting errors. Wages and salaries are less directly affected by legislation.

Figure 11.

Interest Rate on 10-Year Treasury Notes: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Federal Reserve.

Notes: Actual and forecast data show the geometric average of the interest rate over two-year periods. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Forecasts of the Moody's Aaa corporate bond rate were used for the years in which the interest rate on 10-year Treasury notes was not forecast: 1984 and 1985 for CBO's forecasts and 1984 through 1995 for the *Blue Chip* consensus forecasts.

Data are annual and are plotted from 1984 through 2012.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

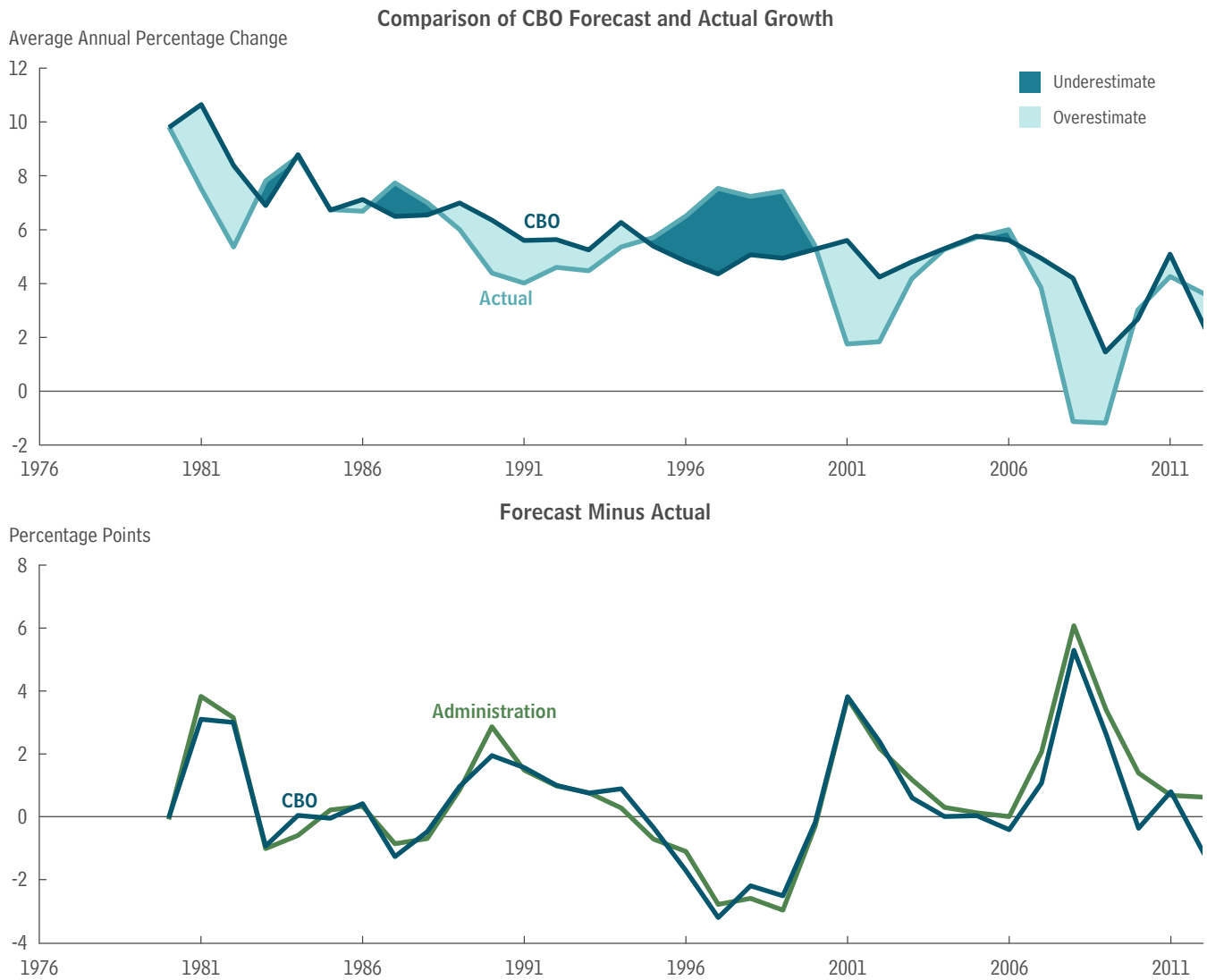
■ **Income shares.** Income shares refer to the percentage of each type of income in GDI.²⁹ Unexpected shifts in

the composition of income may cause sizable errors in forecasts of wages and salaries.

29. Gross domestic income includes wages and salaries, domestic economic profits, employee benefits, proprietors' income, rental income, net interest payments, taxes on production and imports, the surplus of government enterprises, business current transfer payments, and depreciation—all minus subsidies.

Growth in Wages and Salaries. Between 1980 and 2012, the projected growth in wages and salaries exceeded actual growth by 0.5 percentage points for CBO and by 0.7 percentage points for the Administration, on average (see Figure 12). As measured by the root mean square

Figure 12.
Growth in Wages and Salaries: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the average annual growth rate of wages and salaries over two-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

The *Blue Chip* consensus does not report forecasts of wages and salaries.

Data are annual and are plotted from 1980 through 2012.

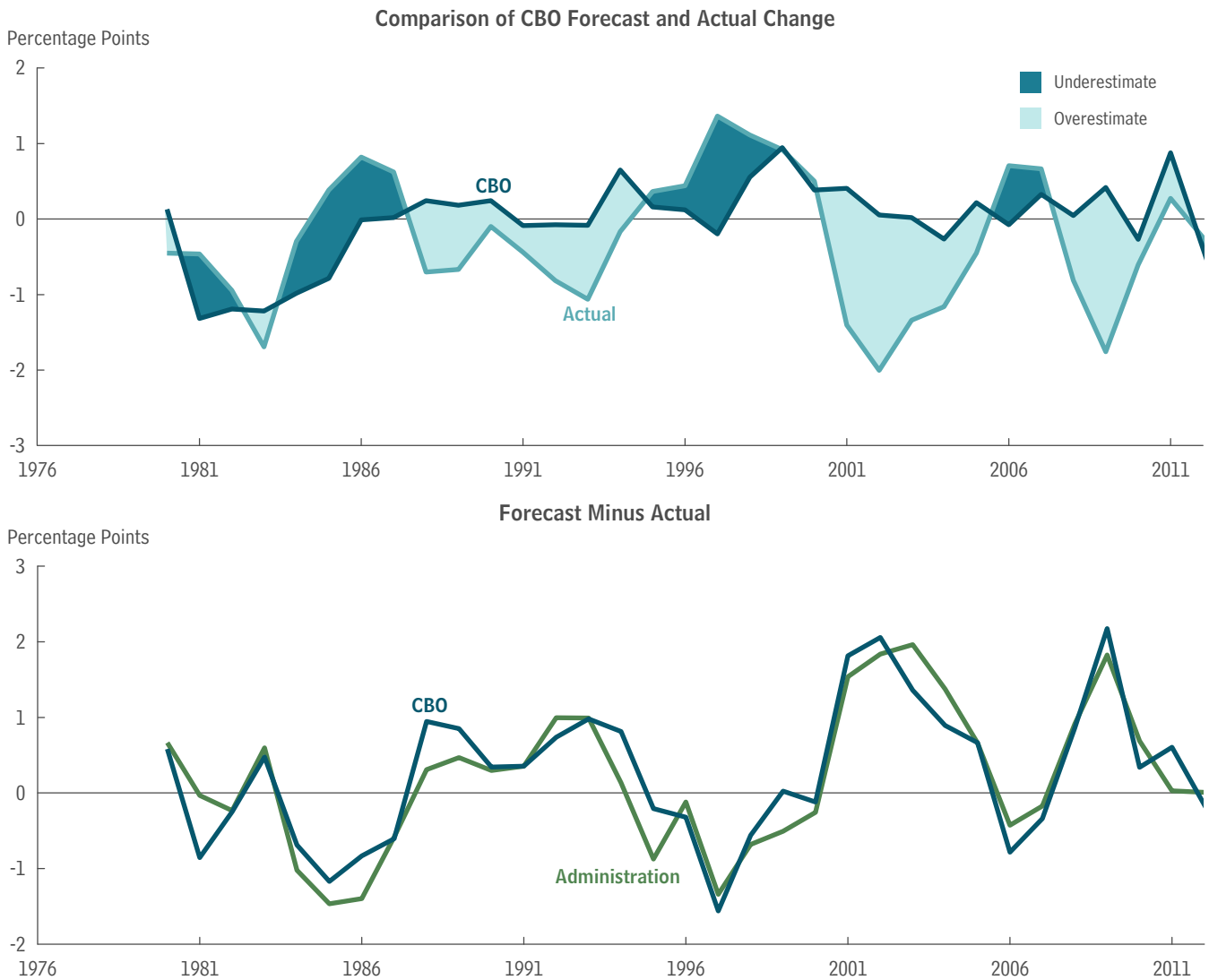
error, forecasts by both agencies deviated from actual growth by about 2 percentage points during that period. The directions of the errors in forecasting the growth of wages and salaries were similar to those for the errors in forecasts of nominal output, indicating that the errors stemmed in part from errors in predicting the growth of both real output and prices.

Change in Wages and Salaries as a Share of Output.

To isolate the errors that were unique to the forecasts of wages and salaries, evaluating those forecasts as a share of output is helpful (see Figure 13). Historically, two patterns have been notable:

Figure 13.

Change in Wages and Salaries as a Share of Nominal Output: Two-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the change in wages and salaries as a percentage of nominal output over two-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the two-year period.

Nominal output is either gross domestic product (GDP) or gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

The *Blue Chip* consensus does not report forecasts of wages and salaries.

Data are annual and are plotted from 1980 through 2012.

- Wages and salaries as a share of output typically move in a cyclical pattern, falling during periods of high unemployment and rising when labor markets tighten.
- Since the early 1970s, the share has followed a downward trend. In part, that trend has stemmed from the fact that employers and employees have substituted untaxed noncash, or fringe, benefits (such as employer-paid health insurance premiums and pension contributions) for taxable wages and salaries.³⁰ Other factors, such as technological change and globalization, also appear to have contributed to the decline in the share during the past two decades.³¹

Between 1980 and 2012, forecasts of the two-year change in the wage and salary share displayed a very slight bias, with average overpredictions of about one-quarter of a percentage point.³² As measured by the root mean square error, forecasts by both CBO and the Administration deviated from the actual change in the share by about 1 percentage point.

During the first half of the 1980s, wages and salaries fell markedly as a percentage of GNP. In large part, that decline can be attributed to the 1980 and 1981–1982 recessions. CBO and the Administration correctly anticipated a decline in the wage and salary share but predicted a larger decline than what actually occurred in most years.

Following a slight rebound in the mid-1980s, the wage and salary share generally declined through the first half of the 1990s. To a large extent, that decline derived from a large and unexpected increase in the statistical discrepancy, indicating that the measure of total output grew faster than the measure of total income. That shift in the discrepancy probably explains overpredictions made by both agencies during the period.

In the late 1990s, wages and salaries grew rapidly as a percentage of GDP, and CBO and the Administration made

30. See, for example, Congressional Budget Office, *How CBO Projects Income* (July 2013), p. 15, www.cbo.gov/publication/44433.

31. Further details about contributions to defined-benefit pension plans are outlined in Congressional Budget Office, *The Budget and Economic Outlook: An Update* (August 2005), Box 2-2, pp. 32–33, www.cbo.gov/publication/17091.

32. For forecasts conducted before 1992, wages and salaries were computed as a percentage of GNP; from 1992 onward, they were computed as a percentage of GDP.

large underpredictions of the change in the share. Three factors probably contributed to the rise in the wage and salary share:

- The statistical discrepancy generally declined during that period, indicating that GDP grew more slowly than GDI.
- Although labor compensation has increasingly been paid in the form of nontaxable benefits in the years since World War II, that trend reversed temporarily as employers' contributions to pension funds and health insurance premiums fell as a share of compensation.³³
- Employee stock options became more prevalent during the 1990s, and gains from exercising stock options count as wage and salary income in the NIPAs. Movements in the wage and salary share of GDP generally corresponded to movements in the stock market in those years.³⁴

During the first half of the 2000s, forecasters expected the wage and salary share to either rise or remain roughly unchanged, but instead it fell sharply. In part, the decline resulted from the shift in labor compensation toward nontaxable benefits. The 2001 recession and sluggish recovery in the labor market also contributed to the decline. However, the recession had only modest effects on output growth and the rate of unemployment, so the decline in the wage and salary share appeared unusually large relative to the severity of the recession.

In forecasts conducted between 2008 and 2010, CBO and the Administration underestimated the effects of the severe 2007–2009 recession on the wage and salary

33. For information about changes in employers' contributions to health insurance during the late 1990s, see, for example, David M. Cutler, *Employee Costs and the Decline in Health Insurance Coverage*, NBER Working Paper 9036 (National Bureau of Economic Research, July 2002), www.nber.org/papers/w9036.pdf (260 KB).

34. See, for example, Hamid Mehran and Joseph Tracy, *The Impact of Employee Stock Options on the Evolution of Compensation in the 1990s*, NBER Working Paper 8353 (National Bureau of Economic Research, July 2001), www.nber.org/papers/w8353.pdf (248 KB); and David Lebow and others, *Recent Trends in Compensation Practices*, FEDS Working Paper 1999-32 (Board of Governors of the Federal Reserve System, July 1999), www.federalreserve.gov/pubs/feds/1999/199932/199932pap.pdf (1.93 MB).

share. In early 2008, neither forecaster anticipated the onset of the recession, which reduced the wage and salary share, and both expected the wage and salary share to be little changed over the following two years. In early 2009, both forecasters had significantly revised their expectations for real output growth downward because of the recession; however, they did not anticipate resulting effects on the wage and salary share over the following two years. Assuming that fiscal policy would follow current law, CBO actually forecast a slight increase in the wage and salary share toward the end of 2010 in anticipation of tax policy changes scheduled to take effect in 2011.³⁵

For the forecasts in 2011 and 2012, CBO's errors were larger than those of the Administration. CBO expected a larger cyclical rebound in the share than actually occurred in 2011 and a slightly larger decline than actually occurred in 2012, while the Administration made negligible errors in both years.

CBO's Five-Year Forecasts

Like the two-year forecasts, the five-year forecasts by CBO, the Administration, and the *Blue Chip* consensus have generally moved together, showing similar degrees of bias and accuracy (see Table 2).

Compared with two-year forecasts, five-year forecasts by CBO and the others typically have some different characteristics:

- They rely more heavily on underlying trends in the economy. CBO, for example, does not usually forecast fluctuations in the economy after the first few years. Instead, CBO projects output to return to its historical relationship with potential output and other variables to move to their long-term values. Therefore, errors in five-year forecasts often reveal inaccurate projections of the long-term trajectory of the economy.

- They are less likely to produce large errors because of relatively brief or small shifts in economic activity. For example, because CBO's forecast conducted in early 2001 did not anticipate the 2001 recession, CBO overpredicted the average two-year growth rate of real output by about 1½ percentage points but overpredicted the average five-year growth rate by about one-half of a percentage point.
- They are more likely to produce errors because of changes in fiscal policy. CBO's baseline projections assume that future fiscal policies will be consistent with current law, but changes in law can be sizable over a five-year span.

Growth in Output

Between 1982 and 2009, forecasts of the five-year average growth rate for both real and nominal output have deviated from actual growth by roughly 1¼ percentage points, as measured by the root mean square error.

Growth in Real Output. In forecasts conducted between 1976 and 1979, CBO and the Administration overpredicted the five-year average growth rate of real GNP by more than 2 percentage points, on average (see Figure 14). In part, those errors reflect slow productivity growth relative to the preceding trend following the 1973–1975 recession, which led forecasters to overestimate the level of potential output during the late 1970s (see Figure 2 on page 9). Furthermore, forecasts conducted in early 1978 and 1979 did not anticipate the two recessions that occurred during the early 1980s, which contributed to errors made in those years.

Forecasts of the five-year growth of real output by CBO, the Administration, and the *Blue Chip* consensus made during the early 1980s were relatively accurate despite the large and unexpected 1981–1982 recession. That outcome reflected the fact that growth rebounded very strongly after the recession, so cumulative growth during the recession and the subsequent recovery was close to previous forecasts. As economic conditions stabilized after the early 1980s, forecasts remained similarly accurate during the rest of the 1980s and the early 1990s. Between 1980 and 1991, the root mean square errors were 0.3 percentage points for CBO, 0.6 percentage points for the Administration, and 0.5 percentage points for the *Blue Chip* consensus.

35. In early 2009, CBO's fiscal policy assumptions were consistent with the scheduled expiration of major provisions of the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003. Those provisions were subsequently extended. The implications for the agency's baseline forecasts of subsequent legislative changes are discussed in Congressional Budget Office, *What Is a Current-Law Economic Baseline?* (June 2005), www.cbo.gov/publication/16558.

Table 2.
Summary Measures of Performance for Five-Year Forecasts

Percentage Points	CBO	Administration	Blue Chip Consensus ^a
Growth in Real Output (1979–2009) ^b			
Mean error	0.1	0.4	0.0
Mean absolute error	0.9	1.0	0.9
Root mean square error	1.2	1.3	1.1
Growth in Nominal Output (1982–2009) ^b			
Mean error	0.6	0.7	0.7
Mean absolute error	1.0	1.1	1.0
Root mean square error	1.3	1.4	1.3
Inflation in the CPI (1983–2009) ^c			
Mean error	0.3	0.1	0.4
Mean absolute error	0.5	0.5	0.6
Root mean square error	0.6	0.7	0.8
Difference Between Inflation in the CPI and in the GDP Price Index (1983–2009) ^{c, d}			
Mean error	-0.2	-0.3	-0.3
Mean absolute error	0.3	0.4	0.4
Root mean square error	0.4	0.5	0.4
Growth in Wages and Salaries (1980–2009)			
Mean error	1.0	1.1	n.a.
Mean absolute error	1.5	1.6	n.a.
Root mean square error	1.8	1.9	n.a.
Change in Wages and Salaries as a Share of Output (1980–2009)			
Mean error	0.6	0.5	n.a.
Mean absolute error	1.5	1.5	n.a.
Root mean square error	1.7	1.6	n.a.

Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*.

Notes: The mean error is the arithmetic average of the forecasting errors. The mean absolute error is the arithmetic average of the forecasting errors without regard to sign. The root mean square error is calculated by first squaring the errors and then taking the square root of the arithmetic average of the squared errors. Errors are forecast values minus actual values; therefore, a positive error is an overestimate.

To compare forecast and actual data, annual averages were computed for growth rates, inflation rates, and wages and salaries as a share of output.

CPI = consumer price index; CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product; GNP = gross national product; n.a. = not applicable (the *Blue Chip* consensus does not report forecasts of wages and salaries).

- The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.
- Output is either GDP or GNP. GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward. Real output is nominal output adjusted to remove the effects of inflation.
- Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.
- The GNP price index was forecast before 1992; the GDP price index was forecast from 1992 onward.

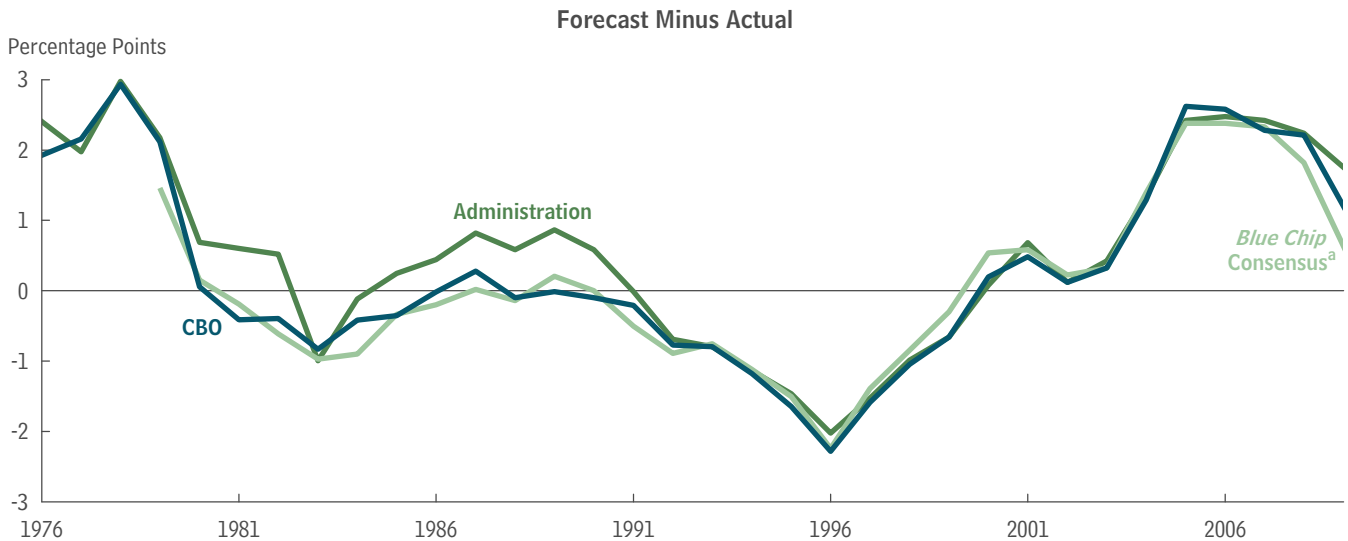
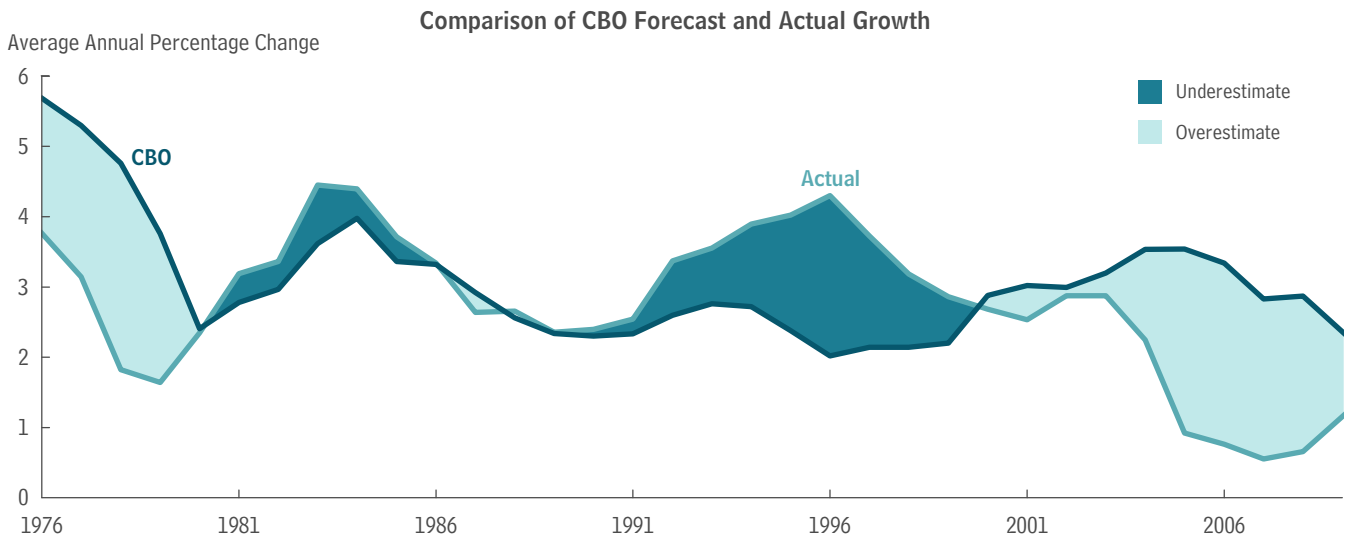
Forecasts made between 1992 and 1999 of the five-year average growth rate of real GDP were too pessimistic. On average, actual growth exceeded projected growth by 1.2 percentage points for CBO and the Administration and by 1.1 percentage points for the *Blue Chip* consensus. Those errors largely resulted from the unexpected investment boom of the late 1990s, which increased the capital

stock and thereby boosted labor productivity and potential output. Methodological revisions by BEA in 1999 also contributed to underpredictions at the end of the period.

In forecasts conducted between 2000 and 2003, CBO, the Administration, and the *Blue Chip* consensus made

Figure 14.

Growth in Real Output: Five-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the average annual growth rate of real output over five-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

Real (inflation-adjusted) output is either real gross domestic product (GDP) or real gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. Real GNP was forecast before 1992; real GDP was forecast from 1992 onward.

Data are annual and are plotted through 2009. Forecasts from the *Blue Chip* consensus are plotted beginning in 1979.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

relatively small overpredictions of the five-year average growth rate of real GDP (less than one-half of a percentage point, on average). A portion of the errors probably stemmed from overestimates of potential output. For example, in early 2002, CBO projected potential output to grow at an average annual rate of 3.0 percent over the next five years; however, CBO now estimates that potential output grew at an average rate of 2.9 percent per year between 2002 and 2006.

The unexpectedly severe and prolonged effects of the 2007–2009 recession account for most of the errors in forecasting the five-year average growth rate of real GDP from 2004 to 2009. Forecasts made between 2005 and 2008, in particular, were much too optimistic. On average during that period, forecasts exceeded actual growth by 2.4 percentage points for CBO and the Administration and by 2.2 percentage points for the *Blue Chip* consensus.

Growth in Nominal Output. Differences in forecasting errors between real and nominal output growth indicate inaccuracies in forecasts of inflation in the GDP price index. For the entire 1982–2009 period covered in this evaluation, all three sets of forecasts overpredicted the five-year growth rate of nominal output by more than one-half of a percentage point, on average. In the 1980s and the early 1990s, forecasters' tendency to overestimate inflation contributed to overpredictions of nominal output growth. In contrast, forecasts conducted between 2000 and 2005 tended to underpredict inflation rates, which partially offset overpredictions of real output growth (see Figure 15).

Inflation

On average between 1983 and 2009, forecasts by CBO, the Administration, and the *Blue Chip* consensus overpredicted inflation in the CPI over the following five years and underpredicted the difference between inflation in the CPI and the GDP price index. As measured by the root mean square error, forecasts of the average five-year rate of inflation deviated from actual inflation by 0.6 percentage points for CBO, 0.7 percentage points for the Administration, and 0.8 percentage points for the *Blue Chip* consensus. For forecasts of the difference between inflation in the CPI and GDP price index, the root mean square errors were about one-half of a percentage point.

Inflation in the CPI. By far, the largest errors in five-year forecasts of inflation in the CPI occurred during the late

1970s and early 1980s (see Figure 16). Forecasts by CBO and the Administration between 1976 and 1979 underpredicted the average inflation rate by over 3 percentage points, on average. As inflation rates fell during and after the 1981–1982 recession, forecasters gradually revised their five-year estimates downward. Between 1982 and 1984, forecasts by CBO and the Administration overpredicted average inflation rates by between 1½ percentage points and 2 percentage points, on average.

As inflation rates moderated after the early 1980s, errors in five-year forecasts also diminished. Forecasts conducted by CBO and the *Blue Chip* consensus between 1985 and 1999 overpredicted the inflation rate by about one-half of a percentage point, on average, while the Administration overpredicted the inflation rate by a negligible amount. Nevertheless, all three forecasts had the same mean absolute error over the 1985–1999 period.

All of the forecasters made only small errors in predicting the five-year average rate of inflation in 2000 and 2001, but they failed to anticipate the rise in that rate after 2001. As a result, they all underpredicted inflation significantly in their 2002–2004 forecasts.

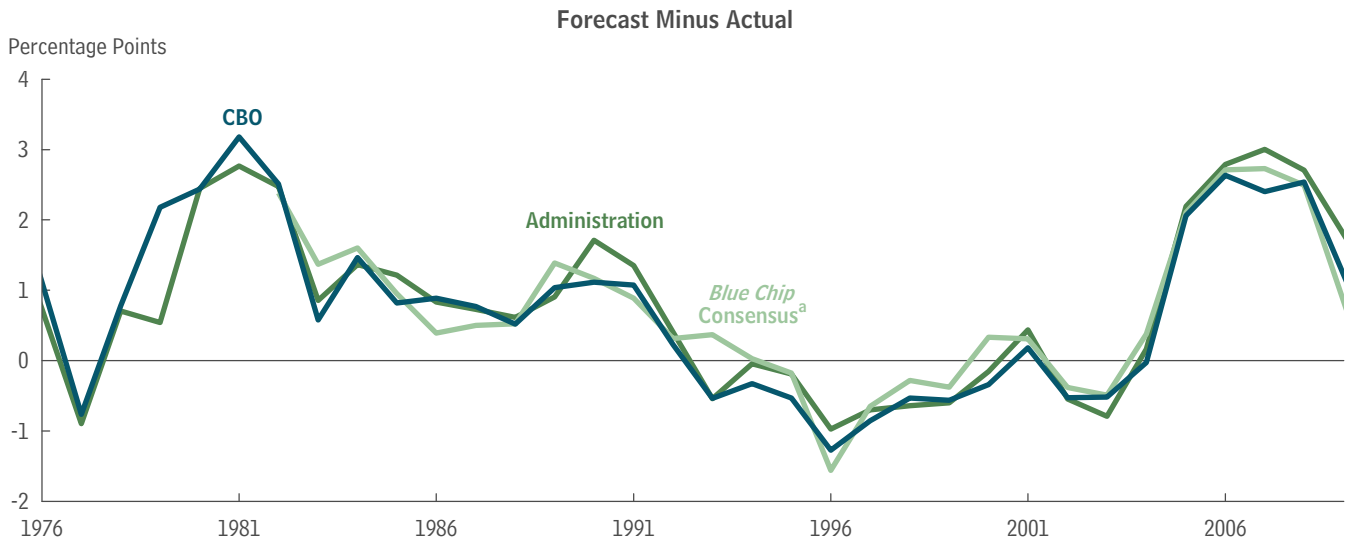
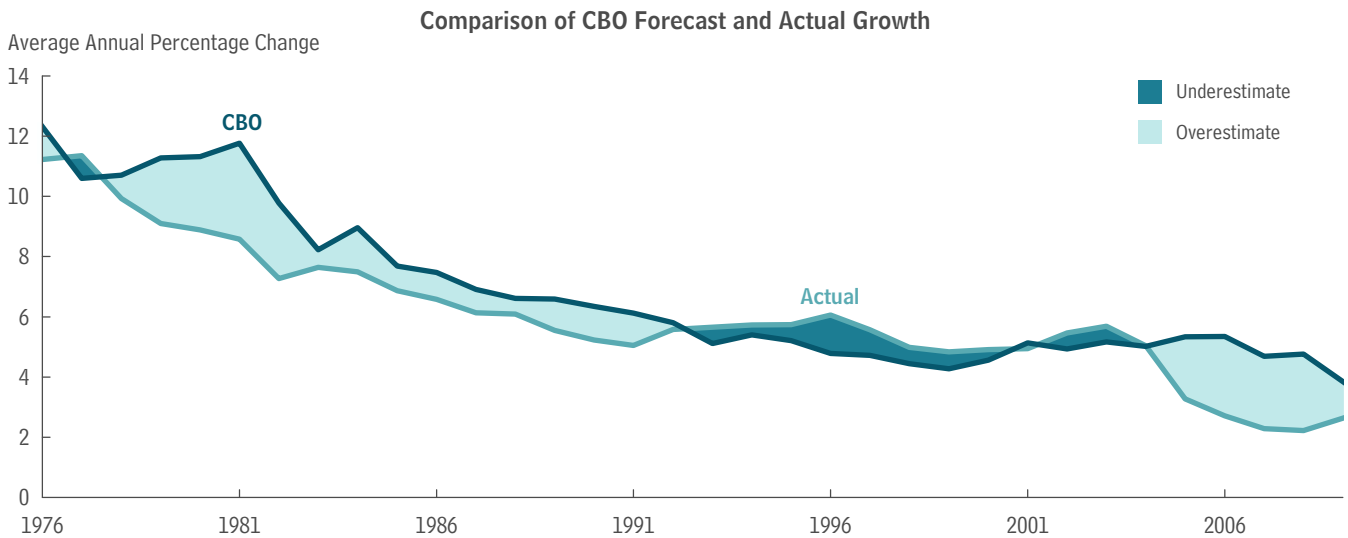
Forecast errors for inflation were generally small from 2005 to 2009. All of the forecasters correctly anticipated a fall in inflationary pressures as a result of the 2007–2009 recession and subsequent slow growth of output. On average, CBO underpredicted inflation slightly, the *Blue Chip* consensus overpredicted inflation slightly, and the Administration predicted inflation accurately.

Difference Between Inflation Measures. In forecasts conducted between 1983 and 1998, CBO, the Administration, and the *Blue Chip* consensus consistently underpredicted the difference between five-year average inflation rates measured by the CPI and the GDP price index (see Figure 17 on page 37).³⁶ On average, the projected difference was below the actual difference by 0.4 percentage points for CBO, 0.6 percentage points for the Administration, and 0.5 percentage points for the *Blue Chip* consensus. About 0.2 percentage points of that bias resulted from downward revisions to inflation in the GDP price index following the comprehensive revision to the NIPAs in 1999.

36. For forecasts conducted before 1992, this evaluation analyzed forecasts of the GNP price index.

Figure 15.

Growth in Nominal Output: Five-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Economic Analysis (BEA).

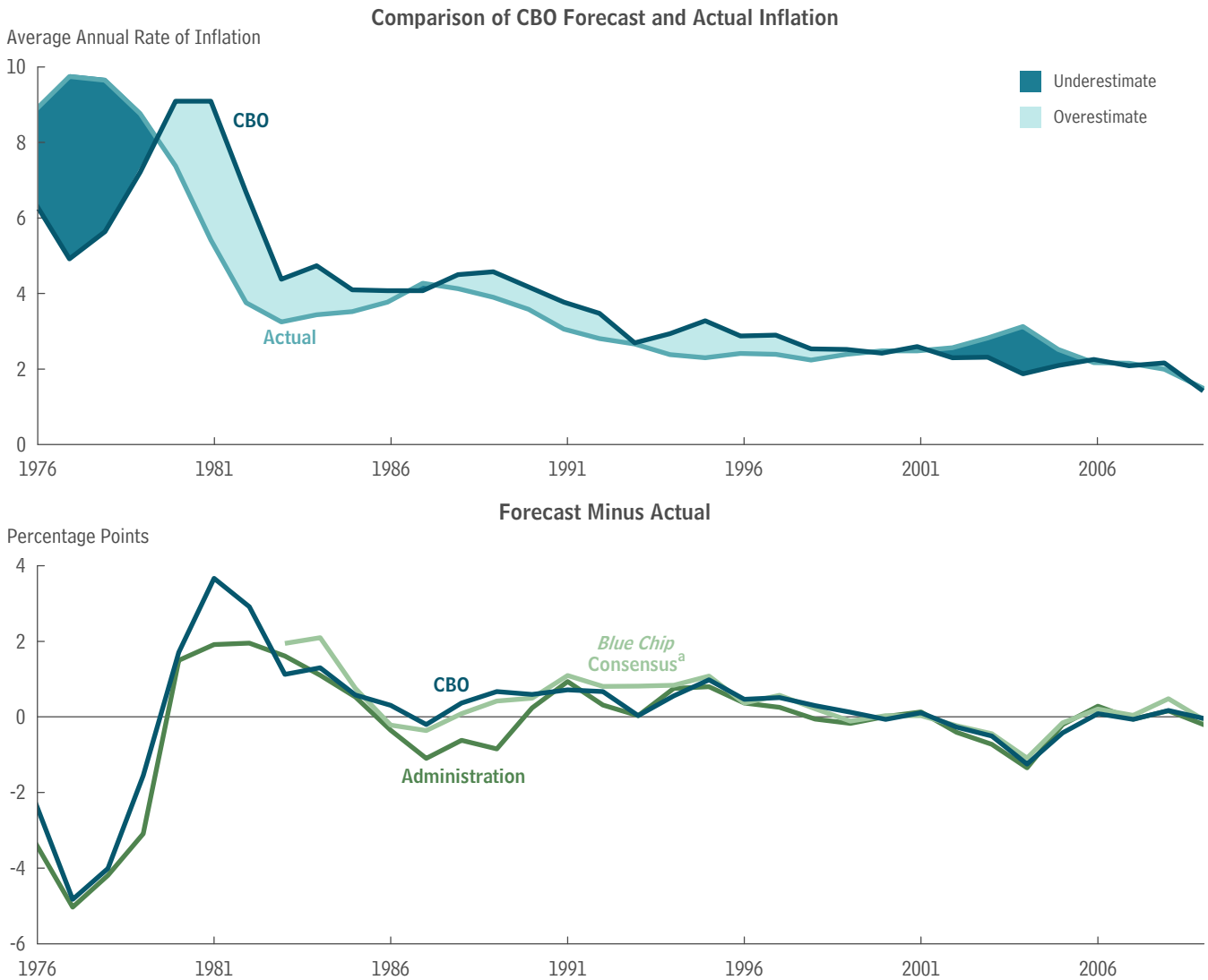
Notes: Actual and forecast data show the average annual growth rate of nominal output over five-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

Nominal output is either gross domestic product (GDP) or gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

Data are annual and are plotted through 2009. Forecasts from the *Blue Chip* consensus are plotted beginning in 1982.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

Figure 16.
Inflation in the Consumer Price Index: Five-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Labor Statistics (BLS).

Notes: Actual and forecast data show the average annual growth rate of the consumer price index over five-year periods. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.

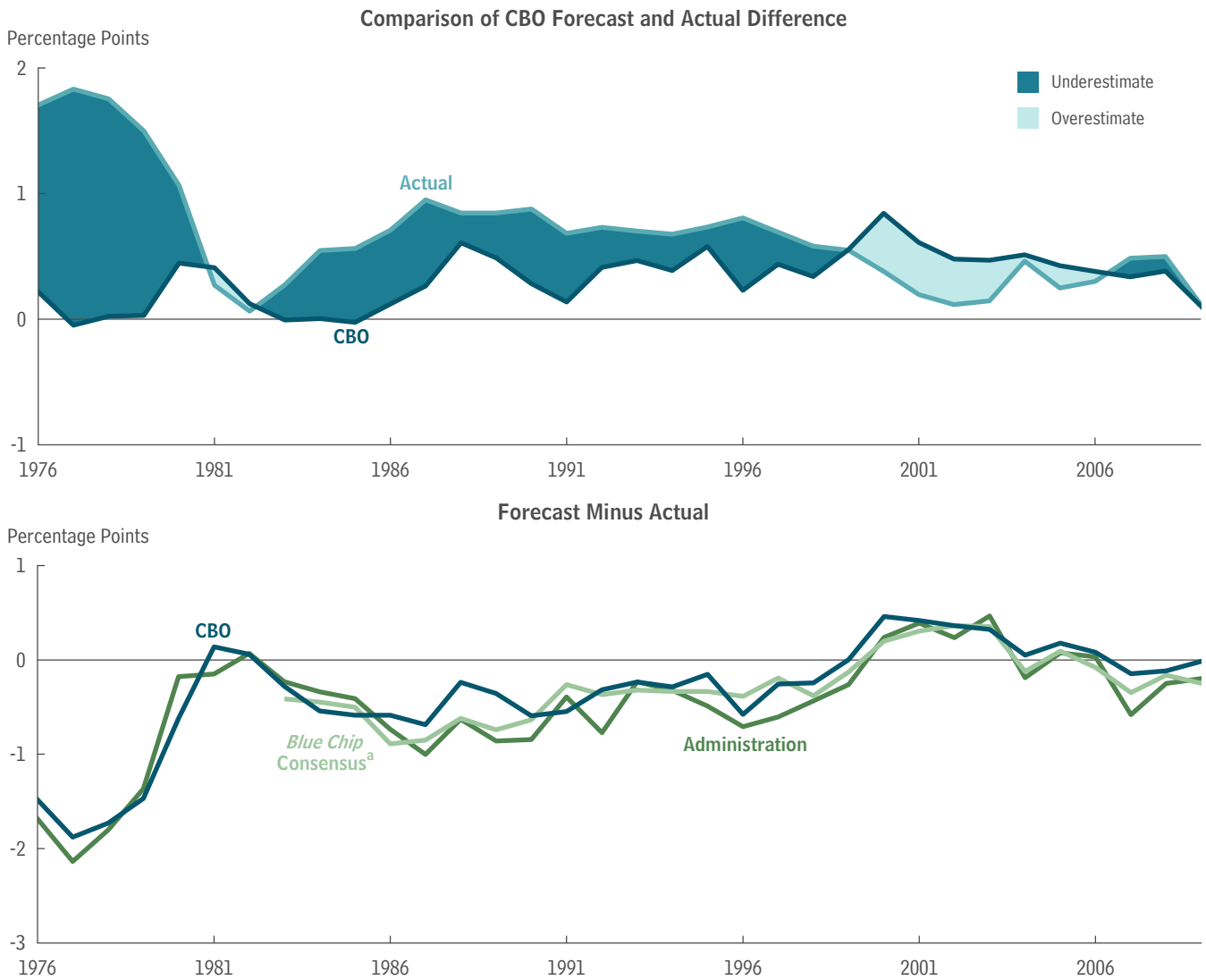
Data are annual and are plotted through 2009. Forecasts from the *Blue Chip* consensus are plotted beginning in 1983.

CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

Figure 17.

Difference Between Inflation in the CPI and in the GDP Price Index: Five-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Aspen Publishers, *Blue Chip Economic Indicators*; Bureau of Labor Statistics (BLS); Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the difference between average annual inflation measures (the CPI minus the GDP price index) over five-year periods. Actual values for the GDP price index are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

Before 1978, BLS published only one consumer price index series, now known as the CPI-W. In January 1978, the bureau began publishing the CPI-U. For most years since 1979, the CPI-U was forecast. However, the CPI-W was forecast by CBO from 1986 through 1989 and by the Administration through 1991.

The gross national product price index was projected before 1992; the GDP price index was forecast from 1992 onward.

Data are annual and are plotted through 2009. Forecasts from the *Blue Chip* consensus are plotted beginning in 1983.

CPI = consumer price index; CPI-U = consumer price index for all urban consumers; CPI-W = consumer price index for urban wage earners and clerical workers; GDP = gross domestic product.

a. The *Blue Chip* consensus is the average of approximately 50 private-sector forecasts.

In forecasts conducted from 2000 to 2003, CBO, the Administration, and the *Blue Chip* consensus did not anticipate that the difference between the two inflation measures would decline significantly. All of the forecasters moderately overpredicted the difference in those years, after moderately underpredicting the difference during the 1990s.

After 2003, forecast errors were generally quite small. The average error for the forecasts from 2004 to 2009 was roughly zero for CBO, -0.2 percentage points for the Administration, and -0.1 percentage point for the *Blue Chip* consensus. The largest errors in absolute magnitude were in 2007: -0.6 percentage points for the Administration and -0.3 percentage points for the *Blue Chip* consensus.

Wages and Salaries

On average between 1980 and 2009, forecasts by CBO and the Administration tended to overpredict growth in wages and salaries and the change in wages and salaries as a share of output over five-year periods. Forecasting errors varied widely over time, however, with substantial underpredictions between 1995 and 1997.

Growth in Wages and Salaries. Between 1980 and 2009, forecasts of the five-year average growth rate of wages and salaries displayed notable upward bias; on average, CBO overpredicted growth by 1.0 percentage point, and the Administration did so by 1.1 percentage points (see Figure 18). As measured by the root mean square error, projections by CBO and the Administration deviated from actual values by 1.8 and 1.9 percentage points, respectively, over that period.

Change in Wages and Salaries as a Share of Output.

Between 1980 and 2009, CBO's and the Administration's projections of the change in wages and salaries as a share of output exceeded the actual change by about 0.5 percentage points, on average (see Figure 19). As measured by the root mean square error, the projected change deviated from the actual change by 1.7 and

1.6 percentage points for CBO and the Administration, respectively.

Forecasts conducted between 1982 and 1986 underpredicted the change in the wage and salary share over the upcoming five years. Those errors may have arisen in part because forecasters overestimated the depth and duration of the cyclical decline in labor compensation relative to output following the 1980 and 1981–1982 recessions. They may also have arisen in part because forecasters overestimated the extent to which labor compensation would shift away from wages in favor of nontaxable benefits.

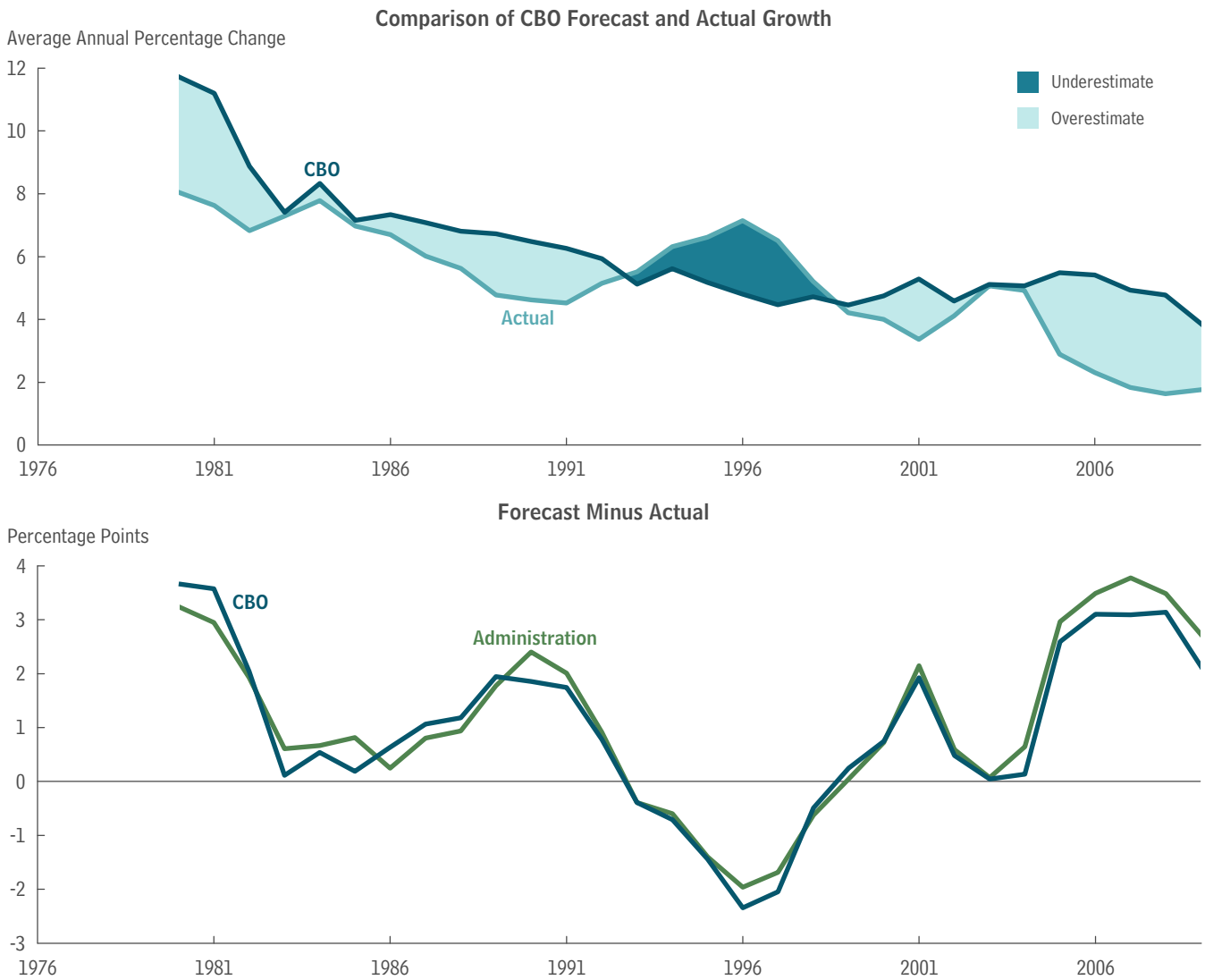
In their five-year forecasts conducted between 1987 and 1993, CBO and the Administration predicted only small changes in the wage and salary share, but, in fact, the share declined significantly over the years covered by those forecasts. The 1990 recession probably contributed to that unexpected decline.

Forecasts conducted between 1994 and 1997 showed relatively small changes in the wage and salary share over each five-year period, but the actual changes exceeded the projected changes by about 2 percentage points, on average, for both CBO and the Administration. As with the two-year forecasts, three factors probably contributed to the increase:

- Measures of income grew more quickly than GDP,
- Labor compensation shifted away from nontaxable benefits in favor of wages, and
- Employee stock options became more prevalent, and the value of the stock market rose.

In almost every forecast conducted between 1999 and 2009, CBO and the Administration projected the wage and salary share to remain roughly flat or to rise slightly over the five-year horizon. However, the change in the share over a five-year span was negative during the 2000s, particularly in the wake of the 2001 and 2007–2009 recessions.

Figure 18.
Growth in Wages and Salaries: Five-Year Forecasts



Sources: Congressional Budget Office; Office of Management and Budget; Bureau of Economic Analysis (BEA).

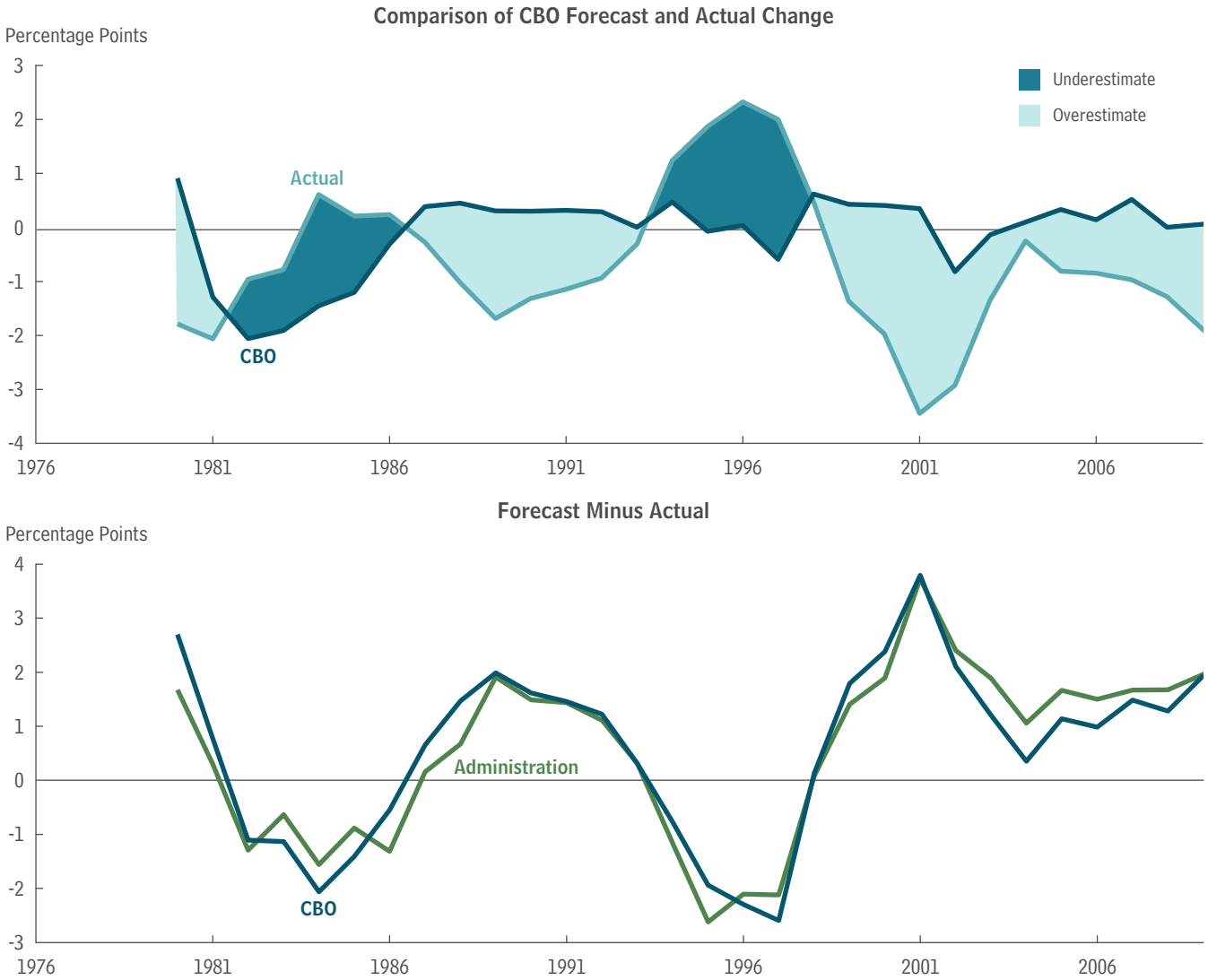
Notes: Actual and forecast data show the average annual growth rate of wages and salaries over five-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

The *Blue Chip* consensus does not report forecasts of wages and salaries.

Data are annual and are plotted from 1980 through 2009.

Figure 19.

Change in Wages and Salaries as a Share of Nominal Output: Five-Year Forecasts



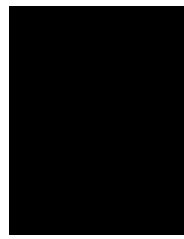
Sources: Congressional Budget Office; Office of Management and Budget; Bureau of Economic Analysis (BEA).

Notes: Actual and forecast data show the change in wages and salaries as a percentage of nominal output over five-year periods. Actual values are based on the most recent data reported by BEA. All forecasts were issued in the first half of the initial year of the period or in December of the preceding year. Date labels refer to the initial year of the five-year period.

Nominal output is either gross domestic product (GDP) or gross national product (GNP). GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment. GNP was forecast before 1992; GDP was forecast from 1992 onward.

The *Blue Chip* consensus does not report forecasts of wages and salaries.

Data are annual and are plotted from 1980 through 2009.



Appendix: Forecast and Historical Data

This appendix offers an overview of the data that the Congressional Budget Office used to evaluate its forecasting record. The evaluation covers forecasts of growth in real (inflation-adjusted) and nominal output, inflation in the consumer price index (CPI), interest rates, and changes in wages and salaries. The historical data for output and the output price index are the current series available from the Bureau of Economic Analysis (BEA). Historical data for inflation and interest rates varied because CBO, the Administration, and the *Blue Chip* consensus used slightly different measures in some years.

Forecasts Used for this Evaluation

The forecasts by CBO and the Administration were originally published in the early months of 1976 through 2012.¹ (Two-year forecasts published in early 2013 were not included because the latest full-year historical data did not extend beyond 2013 when the analysis in this report was completed.) The Administration's forecasts were taken from its annual budget documents in all but one case; the forecast made in early 1981 by the Reagan Administration, based on revisions of the Carter Administration's last budget, came from a separate document.²

The *Blue Chip* consensus forecasts that CBO used for this evaluation were those published as close as possible to the publication date of CBO's forecasts. The first two-year forecast by the *Blue Chip* consensus that CBO used for this evaluation was released in early 1982. Although the *Blue Chip* consensus forecast is published each month, in only two months of the year—March and October—do the forecasts extend beyond two years. All but one of the five-year forecasts from the *Blue Chip* consensus that were

used in this evaluation were published in March; the 1980–1984 forecasts of real output were published in May. The *Blue Chip* consensus forecasts do not include several data series, most notably forecasts of wages and salaries, that are vital for budget projections.

Since 1979, the staff of the Board of Governors of the Federal Reserve System has regularly prepared detailed two-year macroeconomic forecasts for the Federal Open Market Committee (FOMC), the body responsible for conducting monetary policy. Those forecasts are released to the public on a delayed schedule, typically five years later. In conjunction with certain meetings of the FOMC, members of the committee—the members of the Board of Governors and the presidents of the regional Federal Reserve Banks—also compile their own forecasts for selected economic indicators; the range and central tendency of those forecasts have been published in the minutes of the meetings in recent years. CBO's comparison with the forecasts by the staff of the board covers 1979 through 2008 for real output and 1980 through 2008 for the CPI. CBO's comparison with the central tendency of the FOMC members' forecasts of real output and inflation in consumer prices covers 2009 through 2012. All of the Federal Reserve's forecasts used in this analysis were

1. Because CBO has published forecasts for wages and salaries on a regular basis only since 1985, this analysis used some unpublished forecasts for wages and salaries that the agency made in earlier years.

2. CBO's corresponding forecast was taken from the agency's published analysis of President Reagan's budgetary proposals. That forecast by CBO, provided as the agency's baseline projections, did not include the economic effects of the new Administration's fiscal policy proposals, but it did assume the continuation of the tax and spending policies of the Second Concurrent Resolution on the Budget for Fiscal Year 1981, including accelerated depreciation of investment and a 10 percent cut in personal income taxes. Another exceptional case occurred in early 1993, when the Clinton Administration adopted CBO's economic assumptions as the basis for its budget. As a result, the errors from the early 1993 forecast are the same for CBO and the Administration.

issued in January or February of the initial year of the forecast period or in December of the preceding year.

Growth in Nominal and Real Output

Historical two-year average growth rates of nominal output are based on calendar year averages of the most recent quarterly values of gross national product (GNP) and gross domestic product (GDP) published by BEA. In 1991, BEA changed its featured measure of output from GNP to GDP. GNP differs from GDP primarily by including the capital income that residents earn from investments abroad and excluding the capital income that nonresidents earn from domestic investment.

Similarly, figures for real output are based on calendar year averages of the most recent quarterly chain-type annual-weighted indexes of real GNP and real GDP published by BEA. CBO used those recent values because the original real GNP and GDP series were subject to periodic benchmark revisions, making them unsuitable for historical comparisons.

For example, during the 1976–1985 period, forecasters published estimates for a measure of growth in real GNP that was based on 1972 prices, which was the measure published by BEA at that time. In late 1985, however, BEA discontinued the series presented in 1972 dollars and began to publish figures for GNP in 1982 dollars. As a result, an official series of values for GNP growth in 1972 dollars is not available for the years after 1984, and actual two-year average growth rates are not available to compare with the forecasts made in early 1984 and 1985.

Moreover, from 1986 to 1991, forecasters published estimates of growth in real GNP based on 1982 prices. BEA again revised the benchmark in the second half of 1991 by publishing estimates of GNP in 1987 dollars. Today, the historical annual series for GNP presented in 1982 dollars is available only through 1990, and actual two-year average growth rates are not available to compare with the forecasts made in early 1990 and 1991. Late in 1995, BEA made another switch, to a chain-weighted measure of GDP. Therefore, the historical annual series for GDP presented in 1987 dollars ends with the 1994 annual value, and actual two-year average growth rates are not available to compare with the forecasts made in early 1994 and 1995.

By periodically updating the series to reflect more recent prices, BEA's benchmark revisions yield a measure of real

output that is more relevant for analyzing contemporary movements in real growth. But that process makes it difficult to evaluate forecasts of real growth produced over a period of years in series that are later discontinued. Consequently, comparisons in this evaluation use BEA's chain-type annual-weighted index of real GNP or GDP for all historical values.

CPI Inflation

CBO calculated two-year averages of inflation in the consumer price index from calendar year averages of monthly data published by the Bureau of Labor Statistics. Before 1978, the bureau published only one consumer price index series, now known as the CPI-W (the price index for urban wage earners and clerical workers). In January 1978, however, the bureau began to publish a second, broader consumer price index series, the CPI-U (the price index for all urban consumers), including its history.

Until 1992, the Administration published its forecasts for the CPI-W, the measure used to index most of the federal government's spending for entitlement programs. By contrast, for all but four of its forecasts since 1979—specifically, those published from 1986 to 1989—CBO based its forecast of inflation on the CPI-U, the measure of inflation now used to index federal income tax brackets. The *Blue Chip* consensus has always included forecasts for the CPI-U. Although annual fluctuations in the CPI-U and CPI-W are virtually indistinguishable, the indexes differ in some years. For that reason, CBO used historical data for both series to evaluate the alternative forecasting records.

Interest Rates

CBO used monthly data published by the Board of Governors of the Federal Reserve System and the Department of the Treasury to calculate two-year averages of short- and long-term interest rates.

The comparison of forecasts of short-term interest rates relied on historical values for two measures of the interest rate on three-month Treasury bills: the new-issue rate and the secondary-market rate. Before 2001, the Administration forecast the new-issue rate, which corresponds to the price of three-month bills auctioned by the Treasury; it reflects the interest actually paid on that debt. Since mid-2001, the Administration has forecast the secondary-market rate, which corresponds to the price of three-month bills traded outside of Treasury auctions. Such

transactions occur continually in markets that involve many more traders than do Treasury auctions. Thus, the secondary-market rate provides a better measure of conditions in financial markets.

CBO forecasts the secondary-market rate and, unlike the Administration, has never forecast the new-issue rate. The *Blue Chip* consensus has alternated between the two rates. It published the new-issue rate from 1982 to 1985, switched to the secondary-market rate from 1986 to 1991, and then returned to the new-issue rate from 1992 to 1997. Since March 1997, the *Blue Chip* consensus has forecast the secondary-market rate. There is no reason to expect the rates to differ persistently; indeed, the differences between their calendar year averages are minuscule.

CBO likewise compared the various forecasts of long-term interest rates with historical values for two measures of long-term rates: the 10-year Treasury note rate and Moody's Aaa corporate bond rate. A comparison of forecasts is not possible before 1984 because not all of the forecasters published forecasts of long-term interest rates before then. For forecasts made in early 1984 and 1985, CBO projected the Aaa corporate bond rate. From its early 1986 forecast onward, however, CBO projected the 10-year Treasury note rate. The Administration has always published forecasts for the 10-year Treasury note rate, but the *Blue Chip* consensus forecast the

Aaa corporate bond rate until January 1996, when it switched to the 10-year Treasury note rate.

CBO calculated separate historical values for real short-term interest rates using the nominal interest rate and the inflation rate appropriate for each forecaster. In each case, the two-year average interest rate was deflated by the two-year average growth rate of the consumer price index. The resulting real short-term interest rates were similar among forecasts.

Wages and Salaries

The income measure examined here—wage and salary disbursements—focuses on the source of income to which overall tax receipts are most sensitive. In particular, because some other types of income are not taxed (for instance, income derived from assets held in nontaxable accounts), the effective tax rate on wages and salaries exceeds the corresponding rate on other income.

Historical estimates of wages and salaries are subject to substantial statistical revisions. However, those revisions do not have much implication for projections of revenues as long as the revisions are carried forward into the forecast. The result is that the accuracy of forecasts of wages and salaries is measured by using the forecast change of the wage and salary share of GDP.

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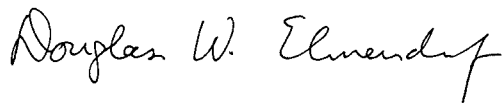
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About This Document

The Congressional Budget Office regularly evaluates the accuracy of its economic forecasts by comparing them with the economy's actual performance and with others' forecasts. Such evaluations help guide CBO's efforts to improve the quality of its forecasts and, as background information, are also intended to assist Members of Congress in their use of the agency's estimates. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Kim Kowalewski of CBO's Macroeconomic Analysis Division wrote the report with guidance from Wendy Edelberg. Robert Arnold of CBO provided helpful comments. Alexander Arnon and Shiqi Zheng provided research assistance.

Jeffrey Kling reviewed the report, and Jeanine Rees edited it and prepared it for publication. The report, along with earlier ones on this topic, is available on CBO's website (www.cbo.gov/publication/49891).



Douglas W. Elmendorf
Director

February 2015