Managing Uncertainty
The Bias and Efficiency of Federal Macroeconomic Forecasts[1]

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Introduction

Analysts at a number of federal agencies are required to generate published but highly uncertain forecasts of economic and demographic conditions well into the future. The Office of Management Budget (OMB) reports underlying economic assumptions that affect aggregate spending and revenue estimates. The Social Security Administration (SSA) relies on economic and demographic assumptions to estimate the long-term solvency of the retirement and medical security trust funds. The Congressional Budget Office (CBO) produces independent measures of many of these estimates (and has also initiated an effort to estimate the uncertainty underlying the projections).

How accurate are economic assumptions and long-range projections produced by these agencies? Macroeconomists interested in the performance of private forecasters have generated a substantial literature and a set of tools for evaluating forecast performance (recently, see Schuh 2001). There have been a few efforts to make similar assessments of government forecasts (Plesko 1988, Belongia 1988, and Miller 1991). We nevertheless know very little about the extent to which performance varies across government agencies or the types of systematic bias observed in government forecasts.

This paper compares actual and projected outcomes for a limited number of macroeconomic indicators -- the inflation rate, a short-term interest rate, annual percent change in the real gross domestic product, and the unemployment rate -- for three agencies. The bias and efficiency of the forecasts are estimated using tests drawn from the macroeconomic literature on private forecast performance and some alternative explanations for observed bias are considered.

The principal substantive conclusions of the paper are that many short-term forecasts are unbiased while long-term forecasts are severely biased. The absence of short-term bias, a surprising result given that private sector forecasts are often biased, suggests the absence of strong incentives for forecast distortion. But a number of agency forecasts are inefficient in the sense that information available to other agencies is not fully incorporated in each forecast. The presence of systematic bias in the long-run forecast, and the fact that some agencies incorporate different types of information or weight similar information differently, suggests that we lack important details about the way that public forecasters manage uncertainty over future performance of the economy.

The Problem of Uncertainty

Public sector managers face pervasive uncertainty. The ways that bureaucrats manage and cope with uncertainty has motivated a number of works on bureaucracy. Crozier (1964) suggests that bureaucrats obtain autonomy or power by offering tools to manage uncertainty. Simon (1974) concludes that bureaucrats adopt a variety of strategies for simplifying decisions to minimize the level of uncertainty associated with choices. Krause (2003) demonstrates how risk management strategies of bureaucrats instruct us

about the ways that individual actors adapt to conditions of uncertainty.

The problem of attaching particular probabilities to the likelihood of future events is at the core of uncertainty. In both the public and private sectors this particular form of uncertainty is pervasive. A common strategy for dealing with uncertainty over future events is the use of a forecast. Firms or agencies publish what they expect to be the likely path of some indicator relevant to agency performance but not under direct agency control. These forecasts both disclose the assumptions agency decision makers have adopted to organize agency work and routines and offer information to managers in other agencies (facilitating coordination across agencies). Forecasts are public, often controversial or contested, and ultimately testable -- how well did a past forecast correspond to current observations?

The way that agencies differ in their approaches to forecasting -- the types of biases they accept and the scope of information that the forecast incorporates -- can illuminate the ways that different types of organizations choose to manage risk or, more broadly, to reduce uncertainty. The particular focus of this paper is the performance of government macroeconomic forecasts, but a broader goal of the inquiry is to generate insights into the way that public sector managers seek to minimize uncertainty -- by either making assumptions about or relying on forecasts about future economic and demographic conditions over which they have little control.

The Rationality of Macroeconomic Forecasts

The diffusion of the rational expectations hypothesis in macroeconomics (notably Muth 1965) stimulated research on the performance of private forecasts. If economic agents are assumed to form rational expectations about the future, then the forecasts produced by firms that purport to provide expert forecasts should conform to criteria that describe optimal or rational forecasts. Since forecasting firms compete in a market, economic actors seeking high quality information about the future should reward accurate forecasters and the market should select firms that produce optimal forecasts. A number of private forecasts, published in the Wall Street Journal or in the widely circulated Blue Chip Survey, are aggregations of forecasts by individual forecasters -- a consensus forecast. The bias and efficiency of the forecasts -- both the individual forecasts and the consensus forecast -- have been investigated in what is now a fairly broad literature on macroeconomic forecast performance (see work by McNees (1978, 1987) and contributions by Fair and Schiller (1989)). One principal result of the early work on forecasting was that private forecasts were in fact biased -- inconsistent with the rational expectations hypothesis (Figlewski and Wachtel 1981). This serious violation of a basic assumption of macroeconomics generated a wide variety of attempts to reconcile forecast bias with rational expectations and efficient markets. Might private forecasters have reasons to generate forecasts that are biased or inefficient?

Ehrbeck and Waldeman (1996) consider the ways that the timing of forecast revisions

could influence forecasters to manipulate both early and late revisions to signal competence to consumers of forecasts. They fail to find evidence of this strategic forecasting bias (and raise more general reservations about the validity of the rational expectations hypothesis), but their work indicates how economists began to investigate the microeconomic business of forecasting to understand the sources of forecast bias. Laster, Bennett, and Geoum (1999) find that individual forecasters consider both forecast accuracy and potential publicity in selecting forecast outcomes. Forecasts generated by analysts in industries that place a premium on publicity tend to be farther from the consensus forecast than forecasts generated by analysts in other sectors of the economy. Publicity-seeking analysts consistently produce forecasts that are distinguishable from the consensus -- the result is a "rational bias" in forecasts.

What can this literature tell us about government forecasting? The government produces forecasts of a variety of macroeconomic indicators. In the 1960s, the White House and the Council of Economic Advisers enjoyed a near monopoly on authoritative government forecasts. But the creation of the CBO and improvements in forecasting technology have led to a number of reported forecasts from government agencies. A limited number of works (Belongia 1988, Plesko 1988, Williams 1991) have tested the bias and efficiency of CBO and OMB forecasts. Williams (1991) finds substantial inefficiency in CBO deficit projections. Belongia (1985) concludes that OMB and CBO forecasts are unbiased, but that private sector forecasts are more accurate. In a comparison of CBO forecasting with other macroeconomic forecasts, the CBO reports that the mean square error for CBO two year ahead forecasts is similar to both OMB and the private Blue Chip survey.

Using the forecast evaluation techniques first described in Mincer and Zarnowitz (1988) and related tests in Fair and Schiller (1987) -- the tools that are used to test the rationality of private sector forecasts -- I evaluate the performance of OMB, CBO, and SSA forecasts of key macroeconomic indicators. The principal objective is to determine if any of the forecasts are objectively superior and, if the forecasts are biased, if the types of bias observed in the forecasts varies across agencies.

What would motivate a government forecast agency to produce a biased forecast? Agencies that produce forecasts may face micro-level incentives similar to those uncovered in investigation of private forecast bias. These incentives to bias forecasts may be rooted in well-understood political pressures to ensure that assumptions are consistent with desired outcomes (see Stockman, 1986, for an account of this type of bias in early Reagan Administration forecasts). Or the incentive to bias could be related to strategic interactions with other agencies or forecast clients. The first step toward understanding the sources of and consequences of this bias is to actually test for bias using econometric techniques and data collected consistent with work on private forecast performance.

Data

A number of agencies in the federal government publish comprehensive forecasts of macroeconomic performance. OMB, CBO and SSA publish short-term and long-range forecasts for the same macroeconomic indicators. Since the forecast variables and time horizons are the same, direct comparison of agency forecasts is straightforward. Since the early 1970s, CBO, OMB and SSA have published macroeconomic forecasts that follow similar conventions for reporting. Each agency publishes projections for the calendar year average unemployment rate (as measured by the Bureau of Labor Statistics), the percent change in the average calendar year Consumer Price Index for Urban Wage - Earners (CPI-W), the average annual interest rate on 90-day Treasury bills (OMB and CBO only), and the percent change in real calendar year Gross Domestic Product (or, before 1992, Gross National Product). SSA does not report the 90-day Treasury bill interest rate forecast, but does report a forecast for the average interest rate on public debt obligations. This interest rate forecast is used below, where appropriate.

Data from agency projections published in the first quarter of each calendar year from 1976-2003 are used as the basis for comparison in the paper. The OMB data are directly from the January (occasionally, later) budget submission. The CBO data is from either the Economic and Budget Outlook (published in February) or the Five Year Budget Projections (also published in the first quarter). The data used for the paper are the "baseline" CBO projection. The SSA data are from the Annual Trustees Report usually published in February of each year. SSA reports forecasts for varying scenarios -- optimistic, intermediate and worst-cast scenarios. The data used for the paper are from Alternative II or Alternative IIa forecasts, the intermediate scenario in most years. SSA publishes historical tables of observed/true values for each of the indicators, so the accuracy of the forecasts can be evaluated by simply comparing past projections to current performance.

The only complication in the evaluation of forecast performance is the frequent revision of GDP data as reported in the historical tables. The percent change in real GDP is revised over time as underlying nominal GDP data are revised. I use five-year ahead historical data to compare the projections (e.g. projections for calendar year 1975 are evaluated with data on real GDP growth from 1980). Data revisions are infrequent and trivial for the other indicators.

For each calendar year, there are eighteen different projections for each indicator (3 agencies predicting current year values and values at time horizons from one to five years in the future). Each of the eighteen predicted outcomes and the true values for each indicator are displayed in Figures 1 and 2. Both the macroeconomic indicators and the forecasts vary less today than in the past -- the year-to-year differences in the inflation rate, the unemployment rate, and Treasury bill interest rates are lower and less volatile after 1985. Aggregate macroeconomic performance, measured as the percent change in GDP, appears to be the most difficult outcome to accurately project and the most volatile indicator. There are a number of instances where macroeconomic performance exceeded

even the most optimistic projection and a number of cases where performance fell short of even the most pessimistic projections. This is not the case for the inflation or unemployment indicators: outcomes appear within the forecast range in each year. Interest rate forecasts are generally in the same range as observed rates, but there is a persistent downward bias in forecasts. The observed interest rate is consistently at or above the high end of the forecast range.

[*Figures 1 and 2 about here]*

Median Forecasts, by Agency

Agency forecasts of each indicator are fairly similar. The median forecasts for each calendar year indicator are reported in Figures 3 and 4, below. The figures indicate a very persistent result: the OMB forecasts are consistently more optimistic (projecting lower interest rates, lower inflation, lower unemployment, and higher growth) than the CBO. The SSA projections are the most pessimistic (although still consistently biased towards more favorable economic outcomes). This subjective evaluation of agency forecasting behavior suggests that agencies either have different technical capacities or different sources of bias in forecasts. Formal statistical tests can reveal if these differences are systematic.

[Figures 3 and 4 about here]

Evaluating Forecasts

The evaluation of private forecast performance typically relies on three measures of forecast performance: forecast accuracy, forecast bias, and forecast efficiency. Tests for bias and efficiency conform to the prescriptions of the technical literature on private macroeconomic forecast accuracy. A recent review of the performance of private forecasters by Schuh (2001) provides a thorough introduction to these tools of forecast evaluation.

Forecast Accuracy

The simple mean forecast error for each indicator (the average of the forecast less the observed for the entire time period) is displayed by agency in Table 1. This basic descriptive statistic suggests that OMB is most likely to over-estimate the growth rate of GDP, and to under-estimate the rate of unemployment and interest rates. But, by these measures, no agency has a monopoly on forecast expertise in the period. The White House forecast of inflation is highly accurate, but the SSA forecast of GDP is highly accurate (both with mean forecast error close to zero). CBO and SSA both produce, on average, highly accurate forecasts of the unemployment rate. If forecasting technology, micro-level incentives for forecast accuracy, and available information were the same across agencies, then we would not observe these results. Why would the OMB forecasts

include a systematic under-prediction of unemployment, but not a systematic prediction error for the inflation rate? The formal tests outlined in the next section can indicate if these differences in forecast accuracy are a function of forecast bias.

[Table 1 about here]

Forecast bias

The canonical strategy for measuring forecast bias (originally outlined in Mincer and Zarnowitz, 1969) requires a simple OLS regression of the observed value of the indicator (y_k) as a function of the forecast value (y^p_k):

$$y_k = \beta_0 + \beta_1 y^p_k + u_k$$

If the forecast was perfect in each period, then the observed and true values would all fall along the line described by parameters $\beta_0=0$ and $\beta_1=1.00$. If the average or representative forecast falls along the same line, even if the error term is large, then the forecast is unbiased. A forecast of GDP growth, for instance, that consistently over-predicted future growth of GDP by .75 percent could be detected since β_0, the constant, would be equal to 0.75. A simple test of bias is a block F-test of the pair of constraints ($\beta_0=0$, $\beta_1=1$). If this pair of constraints cannot be rejected, then a forecasting procedure can be considered unbiased. The utility and desirability of this forecast evaluation strategy have been the subject of considerable exchange in the forecasting literature. Critics of the approach (notably Granger and Newbold 1986) note a host of econometric problems that are typically overlooked in the estimation of the coefficients: serial correlation of the error term (as errors in forecasting assumptions or technology span multiple periods), and correlation of the magnitude of the forecast (y_k) and the magnitude of the error term (u_k).

To improve the performance of the estimator, two adjustments are made to the procedure. First, data from multiple forecasts horizons are aggregated together, increasing the number of observations in each forecast sample and increasing the power of the test for bias. Second, the sample data are treated as a time series cross sectional panel data set -- with each agency forecast horizon as a panel unit. In any year, each variable (y_k) is associated with eighteen distinct forecasts: the forecasts for agency *j* for time horizon *i*. The model is estimated using OLS with panel-corrected standard errors, as prescribed by Back and Katz (1995). The estimation procedure takes into account the correlation of error across panels (across *i* and across *j*), the correlation of error over time (assumed to be constant across panels) and heteroskedastcity. This approach is quite similar to recent work on private forecast evaluation (Laster et al 1999).

Results of this simple test for bias are reported in Tables 2 and 3, below. Estimates are presented using six samples from the data set: short-term forecasts (current year, one year ahead, and two year ahead forecasts) and long-term forecasts (three, four and five year ahead forecasts) for each agency (OMB, CBO, SSA).

[Tables 2 and 3 about here]

The results indicate that systematic bias is not present in short-term forecasts of GDP growth or inflation from the CBO and SSA or in the unemployment forecasts produced by SSA. OMB forecasts of these indicators are systematically biased. Bias in the forecasts of GDP growth rates and inflation principally appear in the estimate of β_1. Observation of slope coefficients less than 1.00 but greater than 0.00 indicate that forecasts overestimate higher than average future levels of the indicator but underestimate lower than average future levels of the indicator. From the pair of coefficients for OMB short-term forecasts of GDP, for instance, we know that the OMB forecast is highly accurate when GDP growth rate is near 2.3 percent.[2] The coefficients indicate that OMB short-term forecasts overestimate the magnitude of future growth any time the projection exceeds about 2.3 percent. A projection of 3.0 percent GDP growth is associated with an actual outcome of 2.7 percent. If the projection is lower than 2.3 percent, which is rare, OMB will underestimate GDP growth. A projection of 1.7 percent would be associated with an outcome of 1.9 percent. This direction and form of bias is indicated in each of the short-term forecasts.

The unemployment rate and interest rate forecasts reveal a second form of bias. The positive value for β_0 implies an upward bias in forecast value. Each agency is likely to underestimate future unemployment, unless the unemployment rate is quite high. The OMB coefficients indicate that the OMB forecast overstates unemployment only if the projection for unemployment rates is in the top quartile of the observed range (over 6.4%). Otherwise the projection is lower than the observed outcome.

None of the agencies produce unbiased forecasts of future interest rates. The positive coefficient (β_0) in each of the models of interest rates indicates that each agency forecast is systematically biased downward. Forecasting technology in the agencies does not adequately incorporate information about monetary policy choices (which influence these short-term rates) and the observed outcome is consistently higher, by nearly four percent, than the forecast value. This finding is not unusual. Rivlin (1987) attributes broader forecasting problems in the 1980s to a misunderstanding of Fed intentions and Croushore (2001) also notes failures to fully incorporate monetary policy choices in private sector forecasts.

The performance of long-term forecasts is highly inconsistent with rational expectations. The null hypothesis of an unbiased forecast was rejected for every indicator forecast by every agency. Most of the models indicated that the slope coefficient (β_1) was statistically indistinguishable from zero. The agency forecasts appear to have no relationship to true values. More troubling, the same coefficient is statistically significant

[2] The observed outcome is equal to the forecast outcome ($y_k=y^p_k$) if $y^p_k=\beta_0/(1-\beta_1)$. If the OMB predicts GDP to grow at an annual rate of 2.28 percent (1.07/0.47), then mean observed outcome is 2.28 percent.

and negative for all agency forecasts of unemployment and growth. This indicates that as forecast values increased observed outcomes decrease. When long-term forecasts indicate that GDP growth rates should increase and unemployment should decrease, the opposite occurs. This is highly problematic. But the fact that this bias is shared across agencies and indicators points to limitations in technology and forecasting procedures. With the exception of the OMB forecast for interest rates, the magnitude and direction of coefficients in the model are very similar. Either each of the agencies faces similar constraints and incentives to produce biased forecasts (something we did not observe with the production of short-term forecasts) or limits of technology and expertise conspire to generate substantial bias in each agency forecast.

Information in Tables 1, 2, and 3 does suggest some important asymmetries in forecasting accuracy. The magnitude and direction of the pair of coefficients estimated for OMB GDP forecasts indicates that bias in GDP growth rate projections is not a consistent function of the level of GDP. When the GDP growth rate is projected to be high, then the forecast tend to be biased upward. When the GDP growth rate is projected to be low or negative, the forecasts are biased upward by a small margin. The representative forecast is optimistic (consistently over-estimating the true mean), but the degree of optimism is a function of the projected levels of GDP. It could be the case the OMB cost function for forecast error (how the benefits and costs of forecast errors are weighted) is of a form that positive errors are accepted when GDP levels are expected to be high, but positive errors are avoided when GDP levels are expected to be low.

Are forecasts biased during Presidential election years?

The method used to test for systematic bias in agency forecasts can also be used to test for the effects of bias during election years. It would seem that the election year would represent a particularly tempting period to generate optimistic macroeconomic assumptions to support White House spending increases, tax cuts, and deficit reduction strategies. As demonstrated by Reagan-era OMB economic assumptions (the budget revision issued in March, 1983), if forecasts of GDP growth, in particular, are sufficiently optimistic, then future revenue growth can make future budget deficits appear quite manageable. By adding a dummy variable for election years (*elect*) to the forecast bias equation, the magnitude and direction of an election year effect can be estimated. The revised equation is simply:

$$y_k=\beta_0+\beta_1 y^p_k+\beta_2 elect+u_k$$

We would expect to observe β_2 different from zero, or election year bias, in OMB forecasts, possibly in CBO estimates, and most likely not in SSA estimates (presuming that the SSA is somewhat insulated from this electoral pressure). But, replicating the models described above with the election year dummy indicated that there is no systematic bias present in any of the forecasts unique to the Presidential election year. Whatever bias is detected in the forecast is evident in each year, independent of the

proximity of elections. In no case did the election variable even approach statistical significance. For brevity, the tables of estimates for these models are not reported in the paper (since estimated coefficients are nearly identical to estimated coefficient in the tables above).

Forecast efficiency

Forecast performance can also be evaluated by examining the extent to which available data -- either in the form of current information on levels of the other indicators or projected values of the same indicator at other agencies -- can improve forecast performance. The intuition is that if one agency has on hand projections of unemployment rates, inflation rates, or treasury bill yields, then that information should be fully incorporated in the forecast of GDP growth. Similarly, if OMB has forecasts of unemployment rates, then either the forecasting technology or the actual forecast should be available to other agencies to inform their own forecasts of unemployment rates. In some cases, the agencies explicitly use forecasts produced by other agencies. SSA relies on OMB budget assumption in Trustee Reports published in the 1970s. OMB relies on CBO budget assumptions in the first Clinton budget.

Fair and Schiller (1989) propose a simple statistical test to measure the relative efficiency of forecasts produced by two firms. They compare the information content of the primary private sector forecasting firms using the technique. To test whether one set of forecasts is superior to another, a simple linear model is estimated:

$$(y_{kt}-y_{kt-1})=\beta_0+\beta_1(y^p_{k1}-y_{kt-1})+\beta_2(y^p_{k2}-y_{kt-1})$$

y_{kt} is the observed value of indicator k at time t. y_{kt-1} is the observed value of indicator k at time $t-1$. y^p_{kj} is the forecast of indicator k by agency j. Interpretation of the test is straightforward. If $\beta_1>0$ and $\beta_2=0$, then the forecast by agency 2 is relatively inefficient. The forecast of agency 1 contained all of the information in the forecast of agency 2 plus additional useful information for predicting the observed change in the indicator. If $\beta_1=0$ and $\beta_2>0$, then the forecast by agency 1 is relatively inefficient. If $\beta_1>0$ and $\beta_2>0$, then each agency forecast contains unique useful information about the path of y_k. Evaluation of the relative efficiency of a single forecast requires estimation of three models with agency pairs OMB-CBO, CBO-SSA, and OMB-SSA. The results for each indicator are reported in Table 4, below.

[Table 4 about here]

CBO forecasts of real GDP are more efficient than both SSA and OMB forecasts. This efficiency could be a function of technical superiority of CBO models, different forms of incentives or constraints that result in different "cost functions" for forecast errors, or the timing of the CBO data release. A later release in the quarter would permit CBO inspection of more information, including Administration forecasts. If CBO efficiency

was a function of either the timing of the release or technical superiority, then we should observe the same result for each of the macroeconomic indicators. This is not the case. OMB forecasts of inflation and unemployment are more efficient than CBO forecasts. CBO and OMB forecasts of short-term interest rates are both inefficient, with each agency capturing unique information about the future behavior of interest rates. Overall, no agency employs a singularly efficient forecasting technology and each agency forecast could improve if they incorporated information from the other agencies.

Conclusion

Overall, the short-term forecasting performance of government agencies (particularly CBO and SSA) appears to be unbiased, a criteria for rational forecasts that many private forecasts have failed to meet. Further, a number of the forecasts appear to be accurate. It may be the case that the absence of a market for government forecasts minimizes incentives for the type of rational bias in forecasts that has been identified in the private sector.

Persistent long-term bias and relative inefficiency of macroeconomic forecasts suggests that agencies weight or incorporate different types of information in different ways in their forecasts. In the short-run, these alternative weighting schemes do not bias forecasts, but, in the long-run, each of these weighting schemes introduce similar types of biases in forecasts. What accounts for these different weights and varying performance across agencies? Similar puzzles involving the bias and efficiency of private sector forecasts led macroeconomists to consider the risks and rewards in the private business of forecasting and to construct explanations for observed deviation from squared error minimization forecasting strategies.

One potential source of distortion, the proximity of elections, has been rejected as a similar motivation for bias in federal macroeconomic forecasts. Differences in the timing of the release and available forecasting technology are also poor explanations for the observed across agency differences, since some agencies produce more accurate or efficient forecasts of some indicators, but not others. A better theoretical understanding of the public forecast business, the risks and rewards associated with positive and negative or large and small errors, could inform systematic testing of alternative theories of bias in public sector forecasts. Such an investigation could shed considerable light on how incentives and constraints imposed by consumers of information may result in forecasts or expectations that depart from revealed future outcomes in significant ways. More broadly, understanding the way the forecasters manage the risk of forecast error can instruct us about the ways that public sector managers address the pervasive challenge of reducing uncertainty.

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Table 1. Mean Forecast Error, Selected Macroeconomic Indicators, 1976-2003

	OMB	CBO	SSA
Pct. change in real GDP	0.66**	0.39**	0.20
	(2.13)	(2.04)	(2.05)
Pct. change in CPI-W	-0.16	0.38*	0.39**
	(2.42)	(2.47)	(2.42)
Unemployment Rate	-0.36**	-0.08	-0.06
	(1.45)	(1.36)	(1.35)
Treasury bill yield	-2.50**	-1.25**	-0.50**
(except SSA)	(1.93)	(1.60)	(1.96)

Note: Standard deviation of mean forecast error in parentheses, n=147. SSA forecasts the average interest rate on special public debt obligations issuable to the trust funds. ** designates the mean forecast error is significantly different from zero (determined via t-test).

Table 2. Estimate of Bias, Short Term Forecasts.
Selected Macroeconomic Indicators, 1976-2003

Gross Domestic Product			
β_1	0.53**	0.68**	0.62**
	(0.20)	(0.18)	(0.18)
β_0	1.07	1.12	0.94
	(0.74)	(1.07)	(0.65)
ρ	0.12	0.02	0.10
R^2	0.13	0.20	0.16
F-test	6.77**	3.44	4.56
Consumer Price Index			
β_1	0.68**	0.69**	0.72**
	(0.14)	(0.18)	(0.13)
β_0	1.46*	1.12	1.05
	(0.86)	(1.07)	(0.85)
ρ	0.44	0.60	0.54
R^2	0.31	0.31	0.36
F-test	4.79*	3.33	4.54
Unemployment Rate			
β_1	0.77**	0.70**	0.76**
	(0.11)	(0.11)	(0.12)
β_0	1.47**	1.86**	1.49*
	(0.71)	(0.77)	(0.83)
r	0.40	0.38	0.39
R^2	0.56	0.52	0.52
F-test	4.67*	6.57**	3.72
Treasury bill yield (except SSA)			
β_1	0.66**	0.66**	0.21**
	(0.10)	(0.09)	(0.08)
β_0	4.03**	3.66**	6.63**
	(0.72)	(0.65)	(0.83)
ρ	0.45	0.20	0.62
R^2	0.48	0.57	0.45
F-test	45.02**	37.47**	107.88**

Note: Panel corrected standard errors in parentheses, n=78 for each regression,
ρ designates estimate of common AR(1) parameter ** designates $p<0.05$; ** $p<0.10$

Table 3. Estimate of Bias, Long-term Forecasts
Selected Macroeconomic Indicators, 1976-2003

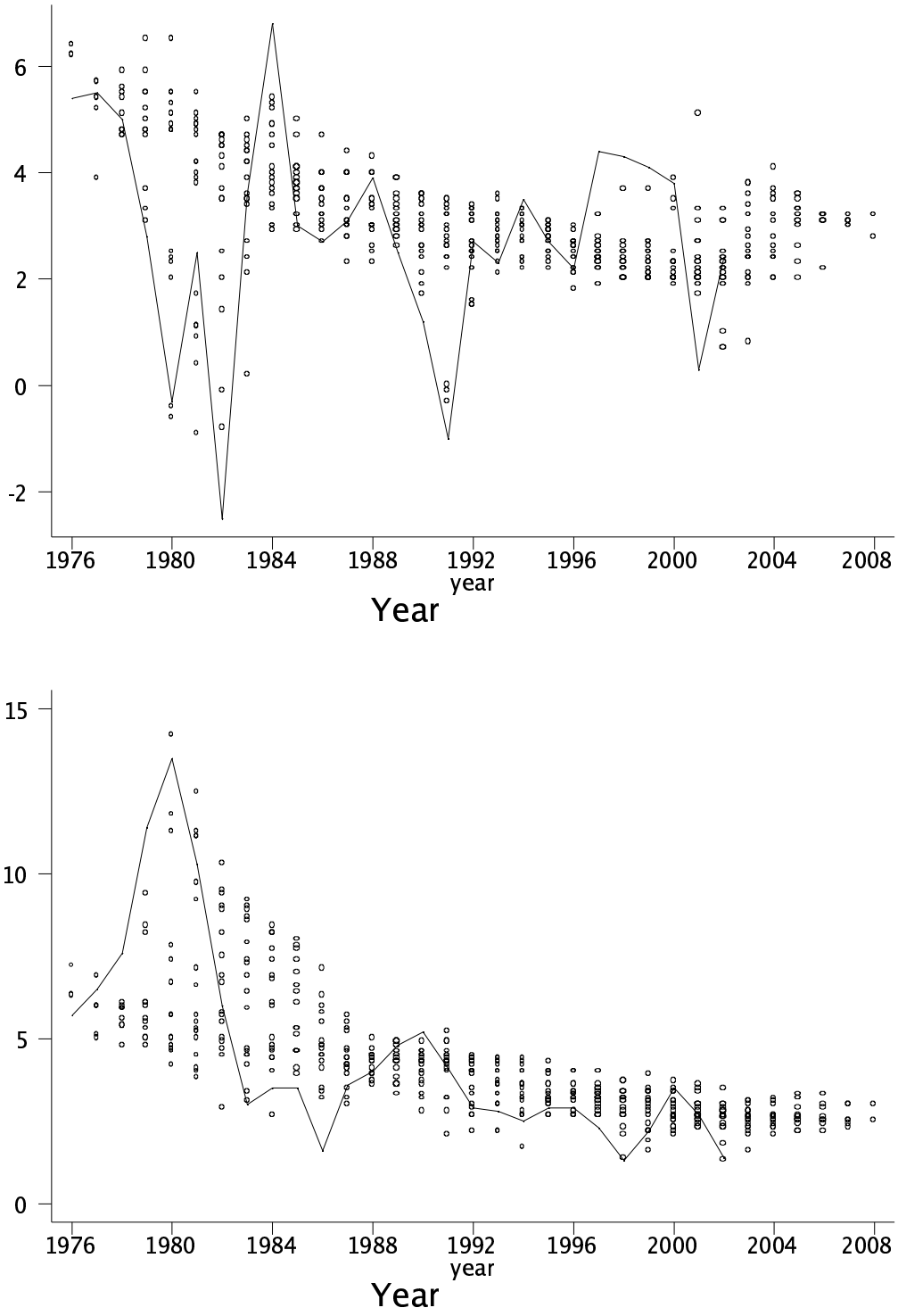
Gross Domestic Product			
β_1	-0.34	-0.43	-0.50**
	(0.36)	(0.43)	(0.34)
β_0	3.75**	3.95**	4.21
	(1.37)	(1.43)	(1.11)
ρ	0.10	0.11	0.14
R^2	0.02	0.03	0.05
F-test	20.16**	13.71**	20.22**
Consumer Price Index			
β_1	0.20	0.16	0.09
	(0.16)	(0.23)	(0.15)
β_0	3.44**	3.44**	4.00**
	(0.82)	(1.18)	(0.91)
ρ	0.57	0.55	0.69
R^2	0.23	0.26	0.27
F-test	24.55**	13.13**	33.89**
Unemployment Rate			
β_1	-0.41**	-0.29*	-0.53*
	(0.17)	(0.14)	(0.25)
β_0	8.57**	8.04**	9.61**
	(1.16)	(1.24)	(1.30)
ρ	0.81	0.83	0.81
R^2	0.38	0.36	0.55
F-test	66.89**	74.31**	58.20**
Treasury bill yield (except SSA)			
β_1	-0.005	0.46**	0.42**
	(0.14)	(0.11)	(0.15)
β_0	8.21**	4.71**	4.78**
	(1.18)	(0.82)	(1.12)
ρ	0.79	0.34	0.56
R^2	0.42	0.40	0.56
F-test	59.05**	34.76**	18.02**

Notes: Panel corrected standard errors in parentheses, n~69 for each regression,
ρ designates estimate of common AR(1) parameter

Table 4. Fair-Shiller pairwise tests for relative inefficiency, Selected Macroeconomic Indicators, 1976-2003

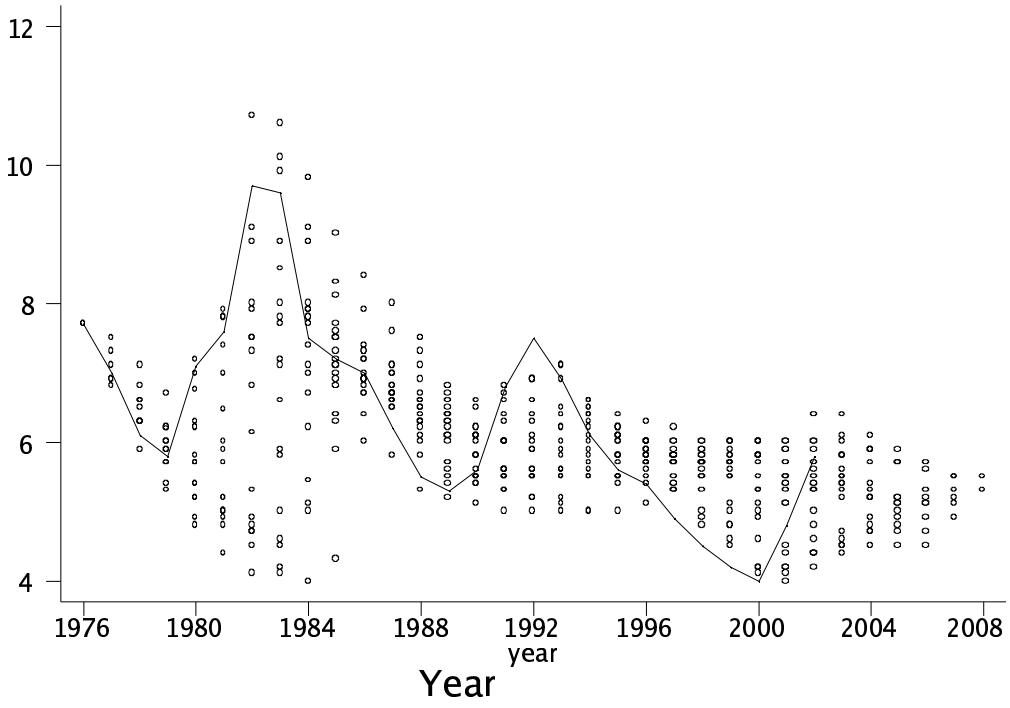
	OMB-CBO	CBO-SSA	OMB-SSA
Gross Domestic Product			
βomb	0.14		0.02
	(0.24)		(0.31)
βcbo	0.63**	0.63**	
	(0.25)	(0.30)	
βssa		0.15	0.73**
		(0.29)	(0.31)
β_0	-0.34*	-0.20	-0.10
	(0.18)	(0.17)	(0.21)
Consumer Price Index			
βomb	0.47**		0.09
	(0.14)		(0.16)
βcbo	-0.22	0.91**	
	(0.15)	(0.30)	
βssa		-0.73**	0.19
		(0.22)	(0.15)
β_0	-0.14	-0.40**	-0.32**
	(0.15)	(0.12)	(0.15)
Unemployment Rate			
βomb	0.20**		0.26*
	(0.10)		(0.14)
βcbo	-0.09	0.09	
	(0.11)	(0.18)	
βssa		0.07	-0.11
		(0.19)	(0.15)
β_0	0.02	-0.04	0.02
	(0.08)	(0.07)	(0.08)
Treasury bill yield (except SSA)			
βomb	0.15**		
	(0.07)		
βcbo	0.12*		
	(0.06)		
β_0	0.28*		
	(0.16)		

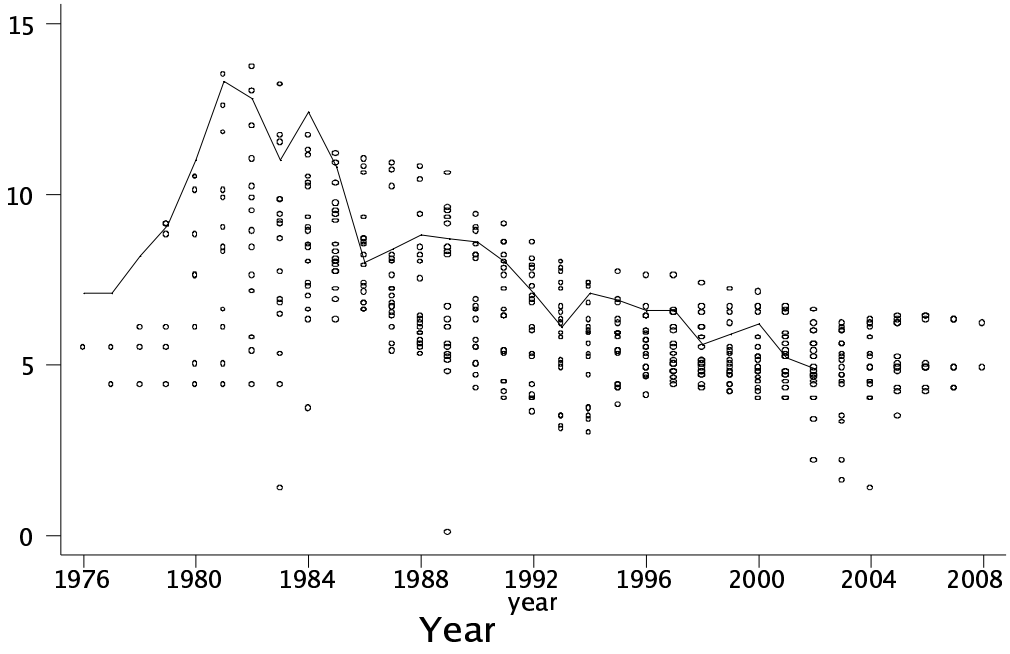
Note: Adjusted standard errors in parentheses, n ~ 140 for each regression



Solid line =actual value; o=forecast

Figure 1.
Actual and forecast values, percentage change in
Gross Domestic Product and Consumer Price Index, 1976-2008





Solid line =actual value; o=forecast

Figure 2.
Actual and forecast values, unemployment rate and yield on 3 month Treasury bills, 1976-2008

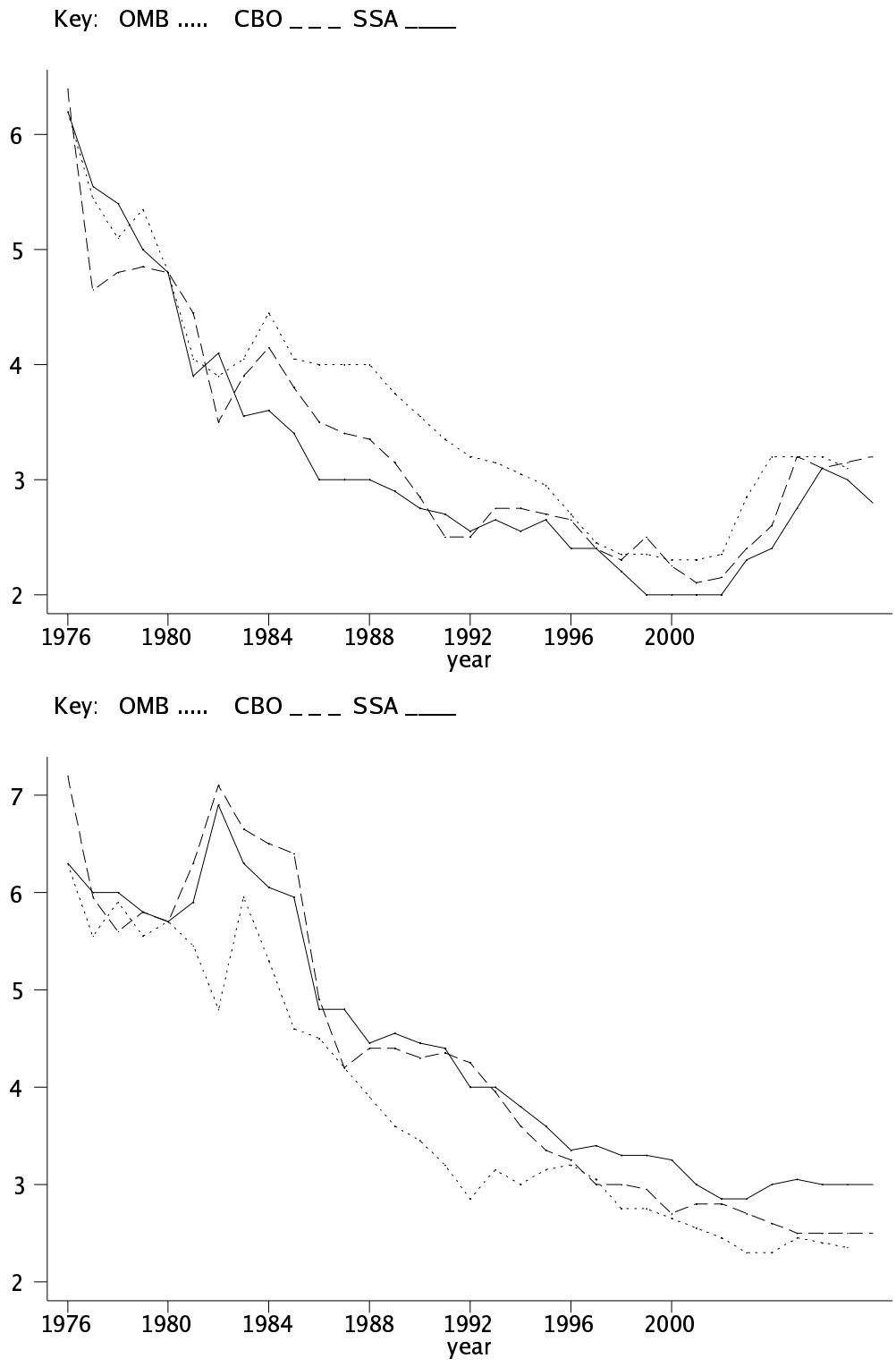


Figure 3. Median forecast, by agency, percentage change in Gross Domestic Product and the Consumer Price Index, 1976-2008

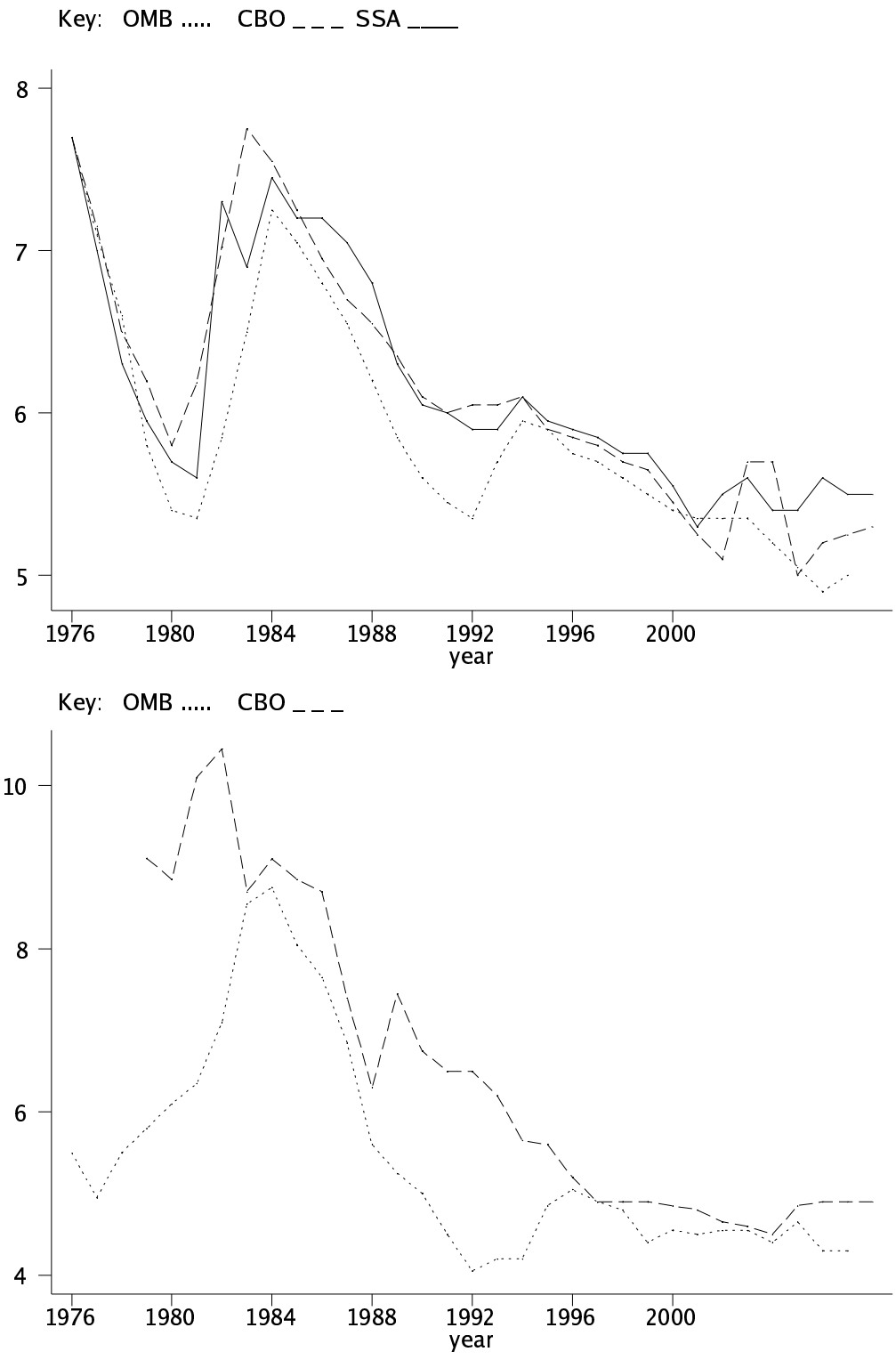


Figure 4. Median forecast, by agency, unemployment rate and yield on 3-monthTreasury bills, 1976-2008