

THE ACCURACY OF GOVERNMENT FORECASTS AND BUDGET PROJECTIONS**

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ABSTRACT

Increased legislative focus on budget estimates brought about by the Gramm-Rudman-Hollings "Balanced Budget and Emergency Deficit Control Act of 1985" and the Tax Reform Act of 1986 has caused the accuracy of government economic forecasts to come under greater scrutiny. This paper examines the record of accuracy of the receipt, outlay, and deficit estimates derived from administration and congressional macroeconomic forecasts to determine the historical reliability of each agency's estimate. The results suggest that the short-run forecasts of CBO and OMB do not contain systematic bias. Over longer periods, however, these projections deteriorated rapidly, particularly that of the budget deficit.

I. Introduction

IN recent years, increasing attention has been paid to budget-related economic forecasts published by the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB). With the passage of the Gramm-Rudman-Hollings "Balanced Budget and Emergency Deficit Control Act of 1985" (G-R-H)¹, forecasts of budget receipts, outlays, and the deficit made by these agencies are used to determine the amount of spending reductions needed in an upcoming fiscal year if the federal deficit is estimated to exceed a predetermined level.

As a result of the increased legislative focus on budget estimates and the implications of a deficit estimate which exceeds the G-R-H guidelines, the accuracy of government economic forecasts has come under greater scrutiny. Some commentators have suggested that budget estimates are inherently sensitive to political pressures which, it is presumed, sacrifice

accuracy in order to mitigate the need to undertake program cuts.

This paper examines the record of accuracy of the receipt, outlay, and deficit estimates derived from administration and congressional macroeconomic forecasts to determine the historical reliability of each agency's estimates. The results suggest that short-run forecasts (two to three years forward) of both CBO and OMB do not contain systematic bias. Over longer periods, however, the forecasts deteriorate rapidly, particularly that of the budget deficit, as they reflect long-term goals for proposed economic policy rather than an actual forecast.

II. Background

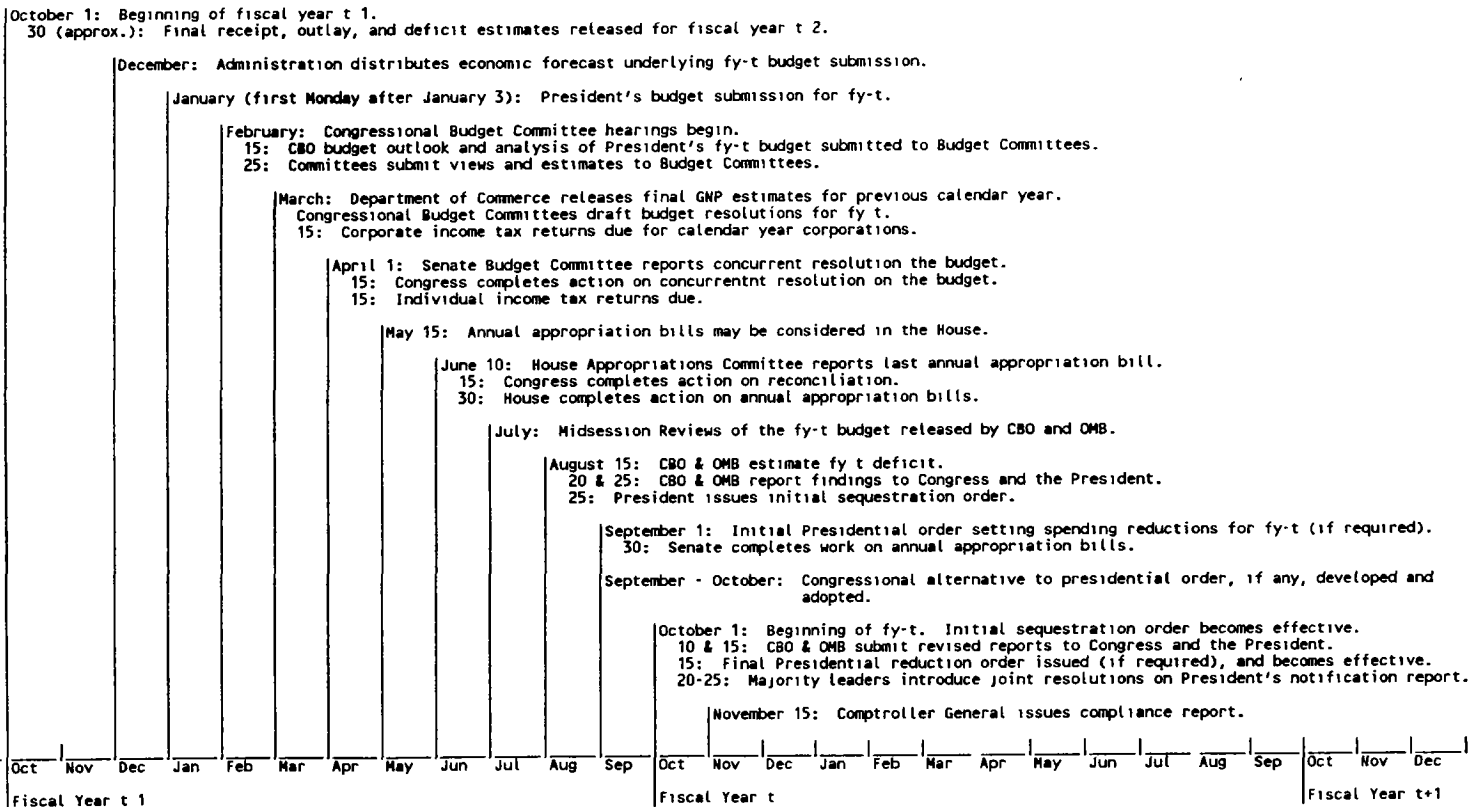
An abbreviated timetable of the budget process is shown in Figure 1. Beginning in December, OMB produces a forecast of the U.S. economy used in the preparation of the President's transmittal to Congress of the *Budget of the United States Government* for the forthcoming fiscal year. This forecast is used by executive branch agencies as the basis for estimates for tax receipts and program outlays for the current and five subsequent fiscal years. As part of the budget submission, two sets of estimates are presented for each fiscal year. The first, current services, is defined by the Congressional Budget Act of 1974 as:

... the estimated budget levels and proposed budget authority that would be included in the budget for the following year if programs and activities of the United States Government were carried on during that year at the same level as the current year without a change in policy.²

The purpose of the current services estimates are to provide a benchmark against which the effects of the Administration's proposals can be compared.³ Since any legislation enacted in a given year can have implications for the level of tax receipts or required government

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FIGURE 1
SUMMARY TIMETABLE OF BUDGET RELATED ACTIVITY



Adapted from: "Congressional Budget and Impoundment Control Act of 1974, as Amended," S. Prt 99-117, Dec. 1985, "Gramm Rudman Hollings and the Congressional Budget Process," S. Prt 99-119, Dec. 1985, and House Report 100-313 on Resolution HJRes 324, September 21, 1987

outlays, the concepts included in the current services estimate will change from year to year. Additionally, changes by OMB in the definition of what constitutes prior-year levels and in the classification of on-budget and off-budget activities will affect the measure of government activity.

The second set of estimates accompanying the President's proposals—proposed law—are the estimates of outlays and receipts that would be realized if all the President's budget proposals were enacted to the exclusion of any other proposals which would affect the budget. Paralleling the work of the Administration, the CBO produces its own set of macroeconomic and current service forecasts, as well as an analysis and re-estimation of the President's proposals using its economic assumptions.⁴ Receipt and outlay estimates are re-evaluated by both agencies later in the fiscal year as part of the Mid-Session Review, using updated economic and legislative assumptions.

The budget process was recently modified by the enactment of G-R-H, which established special procedures for FY 1986–1991 budgets, along with maximum allowable deficit levels.⁵ If the deficit estimate for the upcoming fiscal year as calculated by CBO and OMB on August 15 exceeds the predetermined maximum for that year, spending reductions must be proposed to reduce the level of outlays.

A general perception, at least in the popular press, is that forecasts produced by the government are biased.⁶ Penner [1982] has argued that the passage of the Congressional Budget and Impoundment Control Act of 1974 increased the political pressure on budget forecasts.⁷ He argues that biases arise because changing the set of economic assumptions affecting a proposal or program is politically more acceptable than changing the policy.⁸ This compromising of forecasts to accommodate policy would hold true for both congressional activity, where economic assumptions are voted upon as part of the process, and for budget preparations, where the assumptions could be altered to make the budget proposal more attrac-

tive. The amount of influence these pressures have had on economic assumptions has not been suggested to be large or statistically significant.

Mitigating this possibility, however, would be the existence of competing bureaucratic pressures on any economic assumption, particularly macroeconomic assumptions. What may be a favorable revision in economic assumptions for one program could be an unfavorable change for another. For example, a decrease in forecast values for inflation and interest rates will reduce the cost of carrying any specified amount of government debt and reduce anticipated outlays of programs tied to the CPI (such as social security payments). However, the decline in inflation will also reduce the expected level of government receipts and the future incomes of those constituencies who expect cost of living increases. Given this possibility of competing interests for any forecast variable, either within or outside the government, the pressures may well cancel each other out.

A number of authors have examined the reliability of government macroeconomic forecasts, usually concentrating on three or four variables. Zarnowitz [1986], as part of his most recent study of short-term forecasts and forecasting methodology, included the forecast published in the Council of Economic Advisors' *Economic Report of the President* among those he studied.⁹ Beginning in 1963, and broken down into thirteen different sub-periods, summary measures of errors in annual forecasts were compared for three variables: the growth rate of nominal GNP, the growth rate of real GNP, and the rate of inflation in the GNP implicit price index. The mean absolute percent errors of the forecast variables for the period of his study were 1.2, 1.1, and 1.0 percent, respectively. Of the nine sub-periods which included the CEA's forecast, the mean absolute percent error of the CEA forecast was lower than the mean of the group in four, equal to the mean in three, and higher than the mean in two. For all forecasts evaluated, Zarnowitz finds that "the mean absolute error measures . . . display no systematic upward or downward

trends."¹⁰ All forecasts showed large errors associated with changes in the business cycle.¹¹

Kamlet et al. [1987] analyzed the accuracy of short- and long-term macroeconomic forecasts of OMB and CBO, with particular attention to whether politically motivated or explainable biases were present. The government forecasts were compared to the ASA/NBER series and to simple ARIMA time series models constructed by the authors. Focusing on real GNP growth, inflation, and the unemployment rate, they found that "the Executive branch was slightly optimistic on average" for the years 1962-84 and the sub-period 1969-84, but the "optimism is small in magnitude . . . and in no case approaches statistical significance." For the sub-period of 1976-84, CBO and OMB were found to be slightly pessimistic.¹² In general, the authors conclude that no evidence exists to support the hypothesis that government short run economic forecasts contain systematic bias.¹³ Their conclusion is consistent with Penner's, that "the January forecasts were particularly good for the year in which they were made."¹⁴

Turning their attention to long-term forecasts (beyond two years), Kamlet et al. conclude that the forecasts of CBO and OMB are generally biased toward optimism. However, in the forecast's first two years the optimism of these agencies is less than would exist if the authors' ARIMA forecast process were substituted, and more so thereafter. They conclude that their results support Reischauer's description of long-range projections "not as extended forecasts, but as attainable, non-cyclical paths . . . toward the national goals of full employment and low inflation."¹⁵ This is consistent with the Budget's own statement that longer term assumptions are achievable and dependent upon the adoption of all of the Administration's programs.¹⁶ In contrast to Boskin [1982] they conclude that the forecasts have not improved over time.¹⁷

While the works cited above have examined the accuracy of some of the federal government's macroeconomic forecasts, none have examined the accuracy of the forecasts on which the G-R-H pro-

cess focuses so much attention, namely receipts, outlays, and the resultant deficit estimate.

Receipt and outlay estimates may be better measures of the overall accuracy of government forecasts since they incorporate all of the forecast information produced by OMB or CBO. While aggregate forecasts may be overly/underly optimistic, receipt and outlay forecasts will incorporate other aspects of the forecast which could magnify errors or, through offsetting errors, minimize the effects of inaccuracy in the macroeconomic forecast. While relatively simple methods could be used to forecast individual macroeconomic variables, no one has suggested an alternative way for OMB or CBO to produce a comprehensive national income accounts forecast necessary to the budget process.

CBO has examined the accuracy of their own and Treasury's estimates. In 1981, a CBO staff study evaluated the accuracy of short-run Treasury receipts forecasts for the period 1963 to 1978.¹⁸ The CBO study found that after adjusting for changes in economic and legislative assumptions, receipts estimates "were accurate to within 1 percent of actual collections."¹⁹

In June 1984 CBO analyzed the reasons for errors in its budget estimates for FYs 1980-1982.²⁰ Errors were divided into four categories: economic, legislative, administrative, and technical assumptions. On the revenue side, CBO found economic assumptions to be primarily responsible for errors in estimates, along with errors in assumed legislative outcomes. Overall, the errors were not found to be large: "less than 2 percent in six of seven budget resolutions examined."²¹ Errors in outlay estimates did not arise from a single source, but were largely the result of economic, legislative, and technical assumptions.

III. The Accuracy of Recent Budget Forecasts

To evaluate the accuracy of government budget forecasts, we examine four sets of published estimates: GNP, and the current service estimates of receipts, out-

lays, and deficits. We focus on estimates made since CBO was formed in 1974 so that a comparison can be made of the relative accuracy of CBO and OMB.

Current service measures were chosen since they reflect the assumption of no change in policy.²² While potential policy changes may affect future budgets, they will have little or no effect on the current year. As mentioned earlier, the current services estimates are volatile because the base changes from year to year as new laws are enacted. Using the current services series as a basis for evaluating forecasting accuracy has two effects: 1) since even those budget proposals which were likely to be adopted were not included in the estimates, the comparison will overstate the amount of error in the forecast,²³ and 2) it will cause severe misestimates in years when major unpredicted policy took place, for example, when a new tax law was enacted. However, for these same reasons, use of the current services forecasts has the advantage of making it easier to differentiate sources of the error.

Estimates were drawn from the budget documents released by OMB (in January) and the CBO (usually in February). From each budget, the actual value for the previous year was drawn along with the new forecast for the current and five future fiscal years.²⁴ None of the series was corrected for subsequent revisions, such as the rebenchmarking of the National Income and Product Accounts by the Bureau of Economic Analysis that occurred in 1975, 1982, and 1986. As a result, the actual values for GNP reported here may not agree with current estimates of GNP for those years. Since none of these revisions was available at the time of the forecasts, and budget estimates are not historically rebenchmarked, we will obtain the best picture of accuracy by comparing the estimates to their unrevised realized value. Rebenchmarking that took place during the study period would also have increased the relative error of older forecasts as the revised, and presumably more accurate, historical data were incorporated into a new baseline forecast.

We examine only the levels of the vari-

ables, rather than the rates of change focused on in the macroeconomic evaluations discussed earlier. The nature of the budget process, and the G-R-H process, concentrate on the level of the variable. As such, what is important to policy makers is the degree of accuracy associated with the forecast levels they must use.

A. GNP Projections

We begin our analysis with a comparison of nominal GNP forecasts produced by OMB and CBO. Forecasts of nominal GNP implicitly include forecasts for both inflation and real GNP. The top half of Table 1 lists the calendar year GNP forecasts produced by OMB since January 1976, the time the FY 1977 budget was released, and the errors associated with each.²⁵ The first entry in each row is the actual for the most current year in which data had been released at the time the forecast was published. Subsequent entries in the row list the forecast for the level of GNP for each future year. Reading down any column gives the history of the forecast variable for that year. For example, in Table 1, the column under 1984 shows that the first OMB forecast for 1984 (published in the FY 1980 budget) was \$3546 billion. In the FY 1981 budget the estimate was revised upward to \$4052 billion. The FY 1987 budget reports the actual value for 1984 GNP was \$3775 billion.

The second section of Table 1 shows the percent error associated with each OMB forecast value. The value of the entry shows the percent error of the forecast made at that time in comparison to the final value. Using the same example from the previous paragraph, the FY 1980 forecast of 1984 GNP was off by -6.07 percent. In this section of the table, the diagonal elements are zero (errors associated with actual values), and the elements to their immediate right show the errors associated with that year's estimate of next year's value (for the FY 1989 budget, prepared in late 1987, estimates of 1987 activity).

The bottom half of Table 1 presents the same information for the nominal GNP

TABLE 1
CBO AND OMB FORECASTS OF NOMINAL GROSS NATIONAL PRODUCT, 1975 1987

Calendar year	OMB forecast										1982	1983	1984	1985	1986	1987
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983						
1977	1407	1499	1684	1890	2124	2376	2636	2877	2874	2963						
1978		1516	1693	1880	2092	2334	2579	2784	2784	2963						
1979			1706	1890	2099	2335	2587	2858	3133	3400						
1980				1887	2106	2343	2565	2825	3098	3336	3546					
1981					2128	2369	2567	2842	3206	3619	4052					
1982						2414	2627	2928	3312	3718	4156	4611			5081	
1983							2626	2922	3160	3524	3883	4258	4651		5068	
1984								2938	3058	3262	3566	3890	4232		4599	
1985									3073	3309	3642	3974	4319		4681	
1986										3305	3661	3948	4285		4642	
1987											3775	3992	4274		4629	
1988												3998	4218		4493	
1989													4235		4486	
															4235	4527

Calendar year	percent error of OMB forecast										1982	1983	1984	1985	1986	1987
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983						
1977	0.00	1.12	-1.29	0.16	0.19	-1.57	0.38	2.08								
1978		0.00	-0.76	-0.37	-1.69	-3.31	-1.79	-5.24	-3.58							
1979			0.00	0.16	-1.36	-3.27	-1.49	-2.72	1.95	2.87						
1980				0.00	-1.03	-2.94	-2.32	-3.85	0.55	0.94	6.07					
1981					0.00	-1.86	-2.25	-3.27	4.33	9.50	7.34	12.51				
1982						0.00	0.04	-0.34	7.78	12.50	10.09	15.33	19.98			
1983							0.00	-0.54	2.83	6.63	2.86	6.50	9.82	11.95		
1984								0.00	-0.49	-1.30	5.54	-2.70	-0.07	1.59		
1985									0.00	0.12	-3.52	-0.60	1.98	3.40		
1986										0.00	3.02	-1.25	1.18	2.54		
1987											0.00	-0.15	0.92	2.25		
1988												0.00	-0.40	0.75		
1989													0.00	0.91		
														0.00	0.00	0.00

Calendar year	CBO forecast										1982	1983	1984	1985	1986	1987
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983						
1977	1407	1476	1685	1889	2128	2378	2640	2915								
1978		1516	1698	1885	2085	2304	2547	2809	3103							
1979			1706	1898	2107	2334	2582	2854	3156	3465						
1980				1887	2107	2351	2595	2894	3229	3595	3989					
1981					2128	2369	2555	2849	3210	3611	4050	4529				
1982						2414	2626	2941	3323	3734	4135	4541	4963			
1983							2626	2922	3160	3515	3882	4259	4659	5083		
1984								2938	3058	3266	3580	3903	4221	4540		
1985									3073	3310	3651	3995	4339	4704		
1986										3305	3661	3927	4238	4567		
1987											3775	3993	4269	4583		
1988												3998	4216	4469		
1989													4235	4409		
														4235	4409	4527

Calendar year	percent error of CBO forecast										1982	1983	1984	1985	1986	1987
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983						
1977	0.00	2.64	1.23	0.11	-0.02	-1.51	0.53	-0.78								
1978		0.00	0.49	-0.13	-2.01	-4.54	-3.01	-4.40	0.96							
1979			0.00	0.58	-0.99	-3.32	-1.67	-2.86	2.71	4.85						
1980				0.00	-0.99	-2.61	-8.80	-1.50	5.08	8.77	5.67					
1981					0.00	-1.86	-2.70	-3.03	4.46	9.26	7.28	13.28				
1982						0.00	0.00	0.10	8.14	12.98	9.54	13.58	17.19			
1983							0.00	0.54	2.18	6.35	2.83	6.53	10.01	12.28		
1984								0.00	-0.49	1.18	-5.17	-2.38	0.33	0.29		
1985									0.00	0.15	3.28	0.08	2.46	3.91		
1986										0.00	-3.02	-1.78	0.07	0.88		
1987											0.00	-0.13	0.80	1.24		
1988												0.00	0.45	1.28		
1989													0.00	2.61		
														0.00	0.00	0.00

forecasts produced by the CBO.

Although there is considerable fluctuation in the estimates, the general trends in Table 1 show increasing error as the time horizon lengthens. The forecasts in the FY 1982 budget (released in January of 1981) show the greatest amount of error. This was due to a number of factors outlined by Rivlin [1987]. Largest among

them, an erroneous consensus among most forecasters that economic growth would be strong in 1981, rather than the realized downturn.

Table 2 summarizes the forecasting errors of nominal GNP by OMB and CBO. Each section lists errors by vintage, that is, all of the errors associated with forecasts made for the year just ending, GNP

TABLE 2
SUMMARY OF NOMINAL GNP FORECAST ERRORS

Office of Management and Budget								Congressional Budget Office								
	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)		GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)	
forecast year	1976	1.121	-1.290	0.159	0.188	1.574	0.381	2.076	1976	2.639	1.231	0.106	0.023	1.512	0.533	-0.783
	1977	-0.762	0.371	-1.692	3.314	1.790	-5.242	-3.580	1977	-0.487	0.132	2.011	4.540	-3.008	-4.401	0.963
	1978	0.159	1.363	-3.273	-1.485	-2.723	1.952	2.874	1978	0.583	-0.987	-3.322	-1.668	-2.862	2.714	4.847
	1979	-1.034	-2.941	-2.323	-3.846	0.553	0.938	6.066	1979	-0.907	-2.610	-8.797	-1.498	5.076	8.775	5.669
	1980	-1.864	2.247	-3.268	4.328	9.501	7.338	12.506	1980	-1.864	-2.704	-3.029	4.458	9.259	7.285	13.282
	1981	0.038	0.340	7.777	12.496	10.093	15.333	19.976	1981	0.000	0.102	8.135	12.980	9.536	13.582	17.190
	1982	0.545	2.831	6.626	2.861	6.503	9.823	11.951	1982	-0.545	2.180	6.354	2.834	6.528	10.012	12.282
	1983	0.488	-1.301	-5.536	-2.701	-0.071	1.590		1983	0.488	-1.180	-5.166	-2.376	0.331	0.287	
	1984	0.121	3.523	-0.600	1.983	3.402			1984	0.151	-3.285	-0.075	2.456	3.910		
	1985	3.020	1.251	1.181	2.540				1985	3.020	1.776	0.071	0.884			
	1986	-0.150	0.921	2.253					1986	0.125	0.803	1.237				
	1987	0.401	0.751						1987	0.449	1.281					
	1988	0.906							1988	2.607						
number of observations..	13	12	11	10	9	8	7	number of observations..	13	12	11	10	9	8	7	
mean error.....	0.767	-0.969	0.119	1.267	2.655	4.014	5.084	mean error.....	-0.960	-1.008	-0.591	1.351	2.955	4.848	7.636	
variance.....	0.725	2.609	15.581	21.271	21.774	36.419	82.794	variance.....	1.285	2.234	21.145	21.625	22.376	31.727	38.827	
mean absolute error.....	0.816	1.594	3.153	3.574	4.023	5.325	8.433	mean absolute error.....	1.073	1.523	3.482	3.372	4.669	5.949	7.859	
variance.....	0.648	1.006	5.651	10.101	12.635	24.182	37.525	variance.....	1.055	0.933	9.369	12.081	9.307	19.848	35.361	
t-statistic, Ho: u = 0..	-3.248	2.078	0.100	0.869	1.707	1.881	1.478	t-statistic, Ho: u = 0..	-3.052	-2.337	-0.426	0.918	1.874	2.435	3.242	

	GNP(-1)	GNP(0)	GNP(+1)	GNP(+2)	GNP(+3)	GNP(+4)	GNP(+5)
critical values for t statistic (n-1, .95):							
two-tail.....	2.179	2.201	2.228	2.262	2.306	2.365	2.447
one tail.....	1.782	1.796	1.812	1.833	1.860	1.895	1.943
t statistic for equality of mean errors:	0.470	0.060	0.370	-0.038	-0.128	0.267	0.567

(1), the current year, GNP(0), and extending five more periods. The forecast year identifies the year in which the forecast was made rather than the budget document from which it was drawn. The forecasts published in the FY 1982 budget, for example, are listed as forecast year 1981.

In the case of OMB short-term forecasts, the average error for the value of nominal GNP in the year just ended was -0.767 percent. For the current fiscal year and the fiscal year of the budget submission, the average errors were 0.969 and 0.119 percent. For CBO the respective percent errors were 0.960, 1.008, and

0.591. These errors compare favorably to the short-run forecast errors reported by Zarnowitz. As would be expected, longer run forecasts show increased average percent and average absolute percent errors, and appear to be optimistic on average for the years beginning after the date of the budget document. The relative accuracy of these longer forecasts is difficult to determine since private forecasters generally do not forecast as far forward.

The t-statistics for the hypotheses that the means of the errors were equal to zero are presented for each set of forecast errors. Comparing these values with the critical values listed at the bottom of the table shows the hypotheses that the mean error of the forecasts was equal to zero cannot be accepted for either CBO or OMB's prior or current year nominal GNP projections at the 95 percent level. Additionally, for CBO's $t + 4$ and $t + 5$ forecasts we cannot accept the hypothesis of a zero mean with either a one- or two-tailed test, nor can we accept the hypothesis for the $t + 3$ forecast with a one-tailed test. The hypothesis that the mean error of OMB and CBO was the same for each year cannot be rejected.²⁶

The results in Table 2 further suggest that we should not accept the general conclusion of Kamlet et al. that government macroeconomic forecasts are pessimistic in the short run ($t + 1$ through $t + 3$) based upon either the means or signs of the errors. For the GNP forecasts the test statistics for the hypothesis that the signs of the errors are drawn from a ran-

dom binomial distribution are within a 95 percent confidence region with the exception of both GNP(1) forecasts, for which the probability of having ten of thirteen errors of the same sign is 3.49 percent. In addition, for the administration's GNP(0) forecast, the probability of having ten of twelve signs the same is 1.61 percent.²⁷

One reason for the apparent bias in estimating current year forecasts is the rebenchmarking of the National Income Accounts. Normally when a rebenchmarking occurs it is because previously unmeasured or understated aspects of the accounts are more fully incorporated into the measure. Thus, rebenchmarking will tend to raise the published level of nominal GNP, causing previous forecasts to understate future levels and alter expectations about future economic growth. Rebenchmarking of the National Income Accounts does not have an effect on the measurement of receipts or outlays of the government.

While we have shown the forecast errors of OMB and CBO to be similar we have not explored the policy differences implied by each agency's predicted composition of nominal GNP. Since longer term forecasts are projections of where the economy will be if all budget proposals are adopted, attributing more (or less) of the increase in nominal GNP to an increase in real GNP rather than to inflation may suggest a different interpretation of the effects of an administration's proposed fiscal policy.

B. Current Service Receipts

Tables 3 and 4 present the same descriptive data for receipts as were presented for nominal GNP above. Important to note in these and subsequent tables is that the time period covered by the data has been shifted from calendar years to fiscal years. Thus, when the budget is released in January, the final values for the previous fiscal year (ending September 30) are known, as are actuals for the first (and possibly second) month of the current fiscal year.²⁸ The forecast years in the summary tables again refer to the years in which the forecasts were produced rather

TABLE 3
CBO AND OMB FORECASTS OF CURRENT SERVICE RECEIPTS, FY 1976 FY 1988

fiscal year	OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	281	298	351	407	465	523	585							
1978		300	361	408	465	526	585	635						
1979			357	401	472	540	620	701	775					
1980				402	456	505	571	647	715	778				
1981					466	524	600	691	799	921	1061			
1982						520	608	712	809	922	1053	1189		
1983							599	627	666	723	797	861	926	
1984								618	598	649	713	781	849	927
1985									600	667	737	803	874	960
1986										667	737	794	864	952
1987											734	777	844	927
1988												769	842	910
1989													854	909
1990														909

fiscal year	percent error of OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	0.83	1.57	1.17	-0.13	0.60	-2.32							
1978		0.00	1.12	1.39	-0.19	1.23	2.45	2.75						
1979			0.00	-0.32	1.35	3.77	3.42	13.42	29.07					
1980				0.00	-2.12	2.96	4.67	4.66	19.16	16.70				
1981					0.00	0.73	0.12	11.86	33.07	38.11	44.56			
1982						0.00	1.37	15.22	34.80	38.38	43.39	54.53		
1983							0.00	1.46	10.96	8.48	8.51	11.95	8.38	
1984								0.00	0.38	-2.63	2.87	1.55	0.60	1.98
1985									0.00	0.02	0.44	4.46	2.29	5.61
1986										0.00	0.38	3.28	1.12	4.73
1987											0.00	0.96	1.17	1.98
1988												0.00	1.38	0.15
1989													0.00	0.01
1990														0.00

fiscal year	CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	281	301	372	423	479	537	601							
1978		299	363	407	464	526	594	668						
1979			357	397	457	519	590	668	751					
1980				402	453	502	574	661	749	849				
1981					466	516	582	678	781	905	1053			
1982						520	612	709	810	920	1033	1159		
1983							599	631	652	701	763	818	882	878
1984								618	606	653	715	768	822	878
1985									601	663	733	795	863	945
1986										667	735	788	855	934
1987											734	778	844	921
1988												769	834	900
1989													854	897
1990														909

fiscal year	percent error of CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	0.53	4.13	5.22	2.70	3.27	0.33							
1978		0.00	1.57	1.24	0.41	1.15	-0.83	8.13						
1979			0.00	1.24	1.91	-0.19	1.50	8.13	24.96					
1980				0.00	-2.70	3.46	4.17	6.99	24.63	27.38				
1981					0.00	0.77	2.84	9.74	29.95	35.78	43.44			
1982						0.00	2.15	14.78	34.81	37.97	40.74	50.67		
1983							0.00	2.14	8.49	5.18	3.94	6.36	3.28	
1984								0.00	0.83	2.03	2.60	0.14	3.75	3.41
1985									0.00	-0.53	-0.15	3.37	1.05	3.96
1986										0.00	0.12	2.46	0.12	2.75
1987											0.00	1.16	1.17	1.32
1988												0.00	2.34	0.99
1989													0.00	1.32
1990														0.00

than the budget documents from which they were drawn. As discussed earlier, a number of reasons, independent of any forecasting process, may cause systematic errors in estimates of current services receipts.

Table 3 shows that, as with the GNP forecasts, the largest errors for any particular budget document were associated with the FY 1982 submission. While the

unanticipated downturn of 1981 certainly played a large role in increasing receipts forecast errors, it is also important to note that this was the last budget of the Carter administration. Tax policy changes made during the first year of the Reagan administration, such as the Economic Recovery Tax Act of 1981 (ERTA), signed into law on August 31, 1981, were not included in the baseline. At the time of its

TABLE 4
SUMMARY OF RECEIPTS FORECAST ERRORS

Office of Management and Budget							Congressional Budget Office							
	R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)		R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)	
forecast year	1976	-0.833	-1.569	1.169	-0.129	0.596	-2.319	1976	0.535	4.133	5.224	2.704	3.269	0.334
	1977	1.121	1.393	-0.193	1.231	-2.453	2.752	1977	1.569	1.244	-0.408	1.154	-0.835	8.126
	1978	-0.323	1.352	3.769	3.421	13.419	29.069	1978	-1.244	1.910	0.192	-1.503	8.126	24.958
	1979	-2.125	-2.962	-4.672	4.662	19.157	16.699	1979	2.704	-3.462	-4.174	6.993	24.626	27.382
	1980	0.731	0.117	11.865	33.067	38.110	44.558	1980	-0.769	-2.838	9.744	29.950	35.784	43.441
	1981	1.368	15.215	34.799	38.380	43.386	54.531	1981	2.154	14.778	34.809	37.974	40.744	50.670
	1982	1.457	10.961	8.477	8.514	11.949	8.383	1982	2.137	8.486	5.176	3.937	6.358	3.279
	1983	-0.383	-2.626	-2.874	1.547	-0.597	1.980	1983	0.832	-2.026	-2.602	-0.143	-3.747	-3.410
	1984	0.015	0.436	4.460	2.295	5.611		1984	-0.525	-0.150	3.368	1.054	3.960	
	1985	0.381	3.277	1.124	4.730			1985	0.123	2.457	0.117	2.750		
	1986	0.962	-1.171	1.980				1986	1.157	-1.171	1.320			
	1987	1.382	0.154					1987	-2.342	-0.990				
	1988	-0.011						1988	1.320					
number of observations..	13	12	11	10	9	8		number of observations..	13	12	11	10	9	8
mean error.....	0.075	2.048	5.446	9.772	14.353	19.457		mean error.....	-0.031	1.546	4.762	8.487	13.143	19.347
variance.....	1.089	27.962	106.197	174.903	245.408	392.700		variance.....	2.380	26.380	104.429	170.276	237.771	365.147
mean absolute error.....	0.853	3.436	6.853	9.797	15.031	20.036		mean absolute error.....	1.339	3.637	6.103	8.816	14.161	20.200
variance.....	0.366	20.351	88.891	174.399	225.492	369.801		variance.....	0.587	15.542	89.859	164.581	209.971	331.430
t-statistic, Ho: $\mu = 0$..	0.260	1.342	1.753	2.337	2.749	2.777		t-statistic, Ho: $\mu = 0$..	-0.072	1.043	1.546	2.057	2.557	2.864

	R(0)	R(+1)	R(+2)	R(+3)	R(+4)	R(+5)
critical values for t-statistic (n-1, .95):						
two-tail.....	2.179	2.201	2.228	2.262	2.306	2.365
one-tail.....	1.782	1.796	1.812	1.833	1.860	1.895
t statistic for equality of mean errors:	0.197	0.226	0.149	0.207	0.156	0.011

passage, ERTA was estimated to reduce total receipts by \$1.6 billion in FY 1981, increasing to \$267.7 billion in FY 1986.²⁹

In addition to the FY 1982 estimates, substantial errors occurred in the long-term projections of all submissions prior to FY 1984. These errors also appear to be primarily due to newly enacted legislation. Between the enactment of ERTA in August 1981, and the Tax Reform Act of 1986 (TRA86), in October 1986, eleven major pieces of legislation with revenue consequences were signed into law.³⁰ Those with the most significant revenue effects were the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), the Social Security Amendments of 1983, and the Deficit Reduction Act of 1984 (DEFRA).

Table 4 presents the summary analysis of receipts forecasting errors. The average errors in the forecasts made by CBO and OMB were within 1.3 percentage points of each other throughout the forecast horizon. The average error of the current year forecast made by OMB and CBO, although different in sign, was less than 0.1 percent in absolute value. For the following year, that of the budget submission, the error increases to 1.5 percent for CBO and to 2.0 percent for OMB. An examination of the test statistics shows that the mean errors of the short-run receipt estimates are not statistically different from zero. However, the test statistics for longer term forecasts, beginning with vintage $t + 3$, suggest we cannot accept the null hypothesis that the mean errors were equal to zero. In other words, for both CBO and OMB, the tests indicate an optimistic bias for the three most distant vintage forecast years during the period of study. The tests further indicate that for the period 1974 through 1988, the mean errors in CBO's and OMB's forecasts were not statistically different.

The bias in these out-year forecasts, and the sharp increase in the mean errors, were likely the result of enacted legislation over the period. With the passage of ERTA, all receipts forecasts made before the FY 1983 budget were made obsolete. How well the forecasters incorporated the effects of the many changes in tax law during this period into later GNP and re-

ceipts forecasts raises the additional question of how accurately the revenue consequences of tax proposals were estimated.

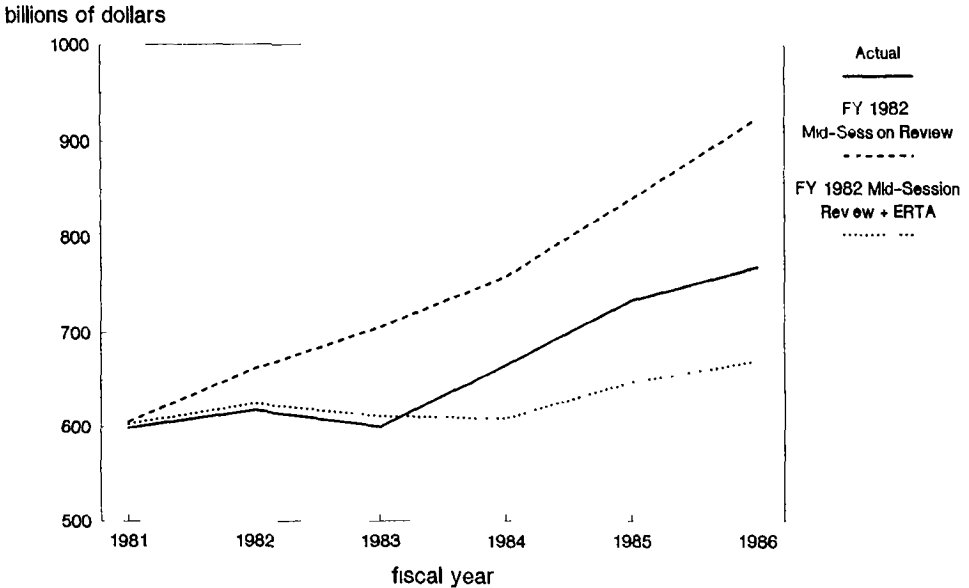
The two main sources of revenue estimates for proposed legislation are Congress's Joint Committee on Taxation (JCT) and the Department of the Treasury's Office of Tax Analysis (OTA). During the congressional deliberations on the TRA86 a number of articles suggested that the behavioral and economic assumptions employed by these groups were incorrect.³¹ While it is beyond the scope of this paper to separately analyze the accuracy of revenue estimating procedures, we can make some inference about their aggregate accuracy. To the extent that the estimates of the effects of newly enacted legislation over the period were substantially incorrect, receipts forecasts which rely on those estimates would show substantial error as well.³²

Tables 3 and 4 show that this was clearly not the case. After enacted legislation estimates were incorporated into the assumptions the error of the estimates was greatly reduced. With respect to ERTA, Figure 2 shows OMB's receipt forecast based on September 1981 assumptions both including and excluding the effect of ERTA. After including the revenue consequences of ERTA, the error for FY 1982 receipts was 1.17 percent and 1.95 percent for FY 1983. The forecasts understate receipts for FY 1983 onward due to the subsequent passage of TEFRA and DEFRA. Later adjustments for these tax bills are reflected in the sharp decline in errors for post-1983 budget submissions. CBO's errors for FY 1985 receipts projections declined from 40.74 percent to 3.94 percent between the FY 1982 and FY 1983 budget projections. The error then dropped to 2.60 percent for the FY 1984 budget submission, which was made before the tax increases called for in DEFRA. Afterwards, errors were less than two-tenths of one percent. For the OMB projections, the decline in error was equally dramatic.

C. Current Service Outlays

As with the receipts estimates, the use of current services outlays forecasts will

Figure 2
Effect of ERTA on Receipts Forecast
September, 1981



be biased to the extent that changes in legislation or national needs affecting the desired level government spending occurred after the estimates were made. Penner has highlighted many reasons for changes in outlays during a given period; natural disasters may cause a sudden increase in necessary expenditures or agencies may find that their spending plans are not fulfilled.³³

Table 5 shows the OMB and CBO forecasts and errors for current service outlays. Comparing the summary data from each in Table 6, we immediately notice two things. First, as with receipts, the size of the errors made by OMB and CBO were very close, usually differing by less than one percent, and not statistically different. Second, outlay estimates were more accurate than receipt forecasts, particularly as the time horizon lengthened. This may well be due to the period chosen for our analysis and the changes in tax law outlined above. While major changes were taking place in the laws governing tax re-

ceipts, government spending remained on a more stable path.

As for the accuracy of the forecasts, the t-tests again suggest that we cannot reject the null hypothesis that the mean error of OMB or CBO outlay estimates were different from zero over the budget horizon, with the exception of CBO's $t + 5$ outlay forecast.

D. Deficits

Finally, we turn our attention to the deficit estimates made in each budget document. Deficit projections are not forecasts in and of themselves, but rather the calculated difference between projected receipt and outlay levels. In addition, the deficit forecast used in the G-R-H process is not the January current service estimate (which we examine here), but the fall current law forecast, which includes newly enacted legislation and the lapsing of expiring legislation. Given its timing, we would expect the G-R-H fore-

TABLE 5
CBO AND OMB FORECASTS OF CURRENT SERVICE OUTLAYS, FY 1976 FY 1988

fiscal year	OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	325	374	392	420	442	465	489							
1978		367	411	440	466	497	527	559						
1979			402	462	500	541	569	604	642					
1980				451	491	536	578	611	640	667				
1981					494	563	616	686	774	839	903			
1982						580	661	736	817	890	968	1050		
1983							675	728	799	869	946	1019	1082	
1984								728	806	880	966	1052	1141	1227
1985									796	854	945	1019	1094	1163
1986										852	960	1025	1109	1200
1987											946	982	1026	1077
1988												990	1017	1061
1989													1005	1056
1990														1064

fiscal year	percent error of OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	1.96	2.49	6.74	10.51	19.77	27.52							
1978		0.00	2.31	-2.40	-5.61	-14.32	-21.91	23.30						
1979			0.00	2.37	1.20	6.66	15.68	17.05	19.41					
1980				0.00	0.49	-7.51	14.39	16.17	19.57	21.68				
1981					0.00	2.81	8.76	-5.78	-2.73	-1.51	4.62			
1982						0.00	2.13	1.07	2.68	4.52	2.28	6.11		
1983							0.00	0.10	0.38	1.97	0.00	2.92	7.67	
1984								0.00	1.27	3.35	2.12	6.25	13.56	15.32
1985									0.00	0.26	0.15	2.97	8.92	9.31
1986										0.00	1.49	3.51	10.42	12.79
1987											0.00	0.79	2.12	1.25
1988												0.00	1.21	0.33
1989													0.00	0.71
1990														0.00

fiscal year	CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	325	375	422	456	488	524	562							
1978		365	413	445	467	491	516	542						
1979			402	458	495	529	565	606	655					
1980				451	494	551	604	655	706	755				
1981				494	560	603	648	685	722	763				
1982					580	660	739	792	843	895				
1983						580	675	740	809	889	971	1052	1130	
1984							675	728	800	850	929	999	1072	1145
1985								728	796	853	928	1012	1112	1227
1986									796	852	949	1003	1086	1183
1987										852	946	986	1025	1086
1988											946	990	1008	1069
1989												990	1005	1055
1990													1005	1064

fiscal year	percent error of CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	2.77	5.10	1.15	1.26	9.59	16.80							
1978		0.00	2.79	1.29	5.41	15.29	-23.54	25.59						
1979			0.00	1.65	0.26	8.73	16.28	-16.80	-17.71					
1980				0.00	0.02	4.93	10.51	10.08	11.31	11.38				
1981					0.00	3.38	10.65	11.04	13.94	15.26	19.37			
1982						0.00	2.24	1.41	0.50	1.02	5.43	4.03		
1983							0.00	1.59	1.63	4.34	2.61	6.28	12.48	
1984								0.00	0.50	0.50	1.83	0.93	6.71	7.61
1985									0.00	0.12	1.93	2.24	10.69	15.32
1986										0.00	0.29	1.33	8.30	11.18
1987											0.00	0.38	2.05	2.07
1988												0.00	0.34	0.47
1989													0.00	0.85
1990														0.00

cast to be less accurate than the current year's deficit forecast, D(0), made approximately four months later, and more accurate than next year's estimate, D(+1), made approximately eight months earlier. Table 7 shows the OMB and CBO forecasts for the deficit.³⁴

By its nature of being a residual, we expect the mean error of the deficit forecast to be larger than those for either re-

ceipts or outlays for three reasons. First, statistically, the variance of the difference of two random variables will exceed the variance of either variable, so long as the covariance between the variables is not negative and greater than half of either's variance (in absolute value)³⁵ If receipt and outlay estimates were independent, the variance of the deficit forecast would be the sum of the variance of

TABLE 6
SUMMARY OF OUTLAY FORECAST ERRORS

Office of Management and Budget							Congressional Budget Office							
	0(0)	0(+1)	0(+2)	0(+3)	0(+4)	0(+5)		0(0)	0(+1)	0(+2)	0(+3)	0(+4)	0(+5)	
forecast year	1976	1.965	-2.488	-6.744	-10.512	-19.772	-27.515	1976	2.769	5.101	1.154	-1.256	-9.593	-16.802
	1977	2.314	-2.396	-5.611	-14.320	21.914	23.298	1977	2.787	-1.287	-5.408	-15.286	-23.544	-25.590
	1978	2.374	1.195	-6.660	-15.676	-17.051	-19.410	1978	1.653	0.263	-8.730	16.284	-16.804	-17.714
	1979	-0.486	-7.505	14.387	-16.172	19.573	-21.683	1979	0.020	-4.934	-10.505	-10.077	11.307	-11.385
	1980	-2.812	8.757	-5.780	-2.726	-1.514	-4.618	1980	-3.382	-10.653	11.038	-13.945	-15.258	-19.370
	1981	-2.134	1.071	2.676	4.520	2.283	6.112	1981	-2.237	1.414	-0.503	-1.021	-5.432	-4.031
	1982	-0.096	0.377	1.972	0.000	2.920	7.675	1982	1.593	1.633	4.343	2.610	6.284	12.483
	1983	1.269	3.346	2.124	6.254	13.558	15.320	1983	0.503	-0.235	-1.828	0.929	6.709	7.613
	1984	0.258	-0.148	2.970	8.919	9.314		1984	0.117	1.934	2.243	10.691	15.320	
	1985	1.490	3.506	10.422	12.791			1985	0.285	1.334	8.302	11.184		
	1986	-0.788	2.120	1.250				1986	-0.384	2.031	2.068			
	1987	1.214	-0.329					1987	0.338	0.470				
	1988	0.714						1988	-0.846					
number of observations..	13	12	11	10	9	8		number of observations..	13	12	11	10	9	8
mean error.....	0.296	-0.834	1.615	-2.692	5.750	-8.427		mean error.....	0.247	-0.566	-1.809	-3.245	-5.958	-9.350
variance.....	2.532	13.952	42.507	106.053	170.448	241.364		variance.....	2.898	14.693	36.696	93.919	146.507	160.809
mean absolute error.....	1.453	2.992	5.509	9.189	11.989	15.704		mean absolute error.....	1.430	2.802	5.102	8.328	12.250	14.374
variance.....	0.721	6.976	14.770	28.861	59.781	65.771		variance.....	1.266	8.216	13.941	35.090	31.945	41.627
t-statistic, Ho: u = 0..	0.672	-0.773	-0.822	-0.827	1.321	-1.534		t-statistic, Ho: u = 0..	0.524	-0.512	-0.991	1.059	1.477	-2.085

	0(0)	0(+1)	0(+2)	0(+3)	0(+4)	0(+5)
critical values for t-statistic (n-1, .95):						
two tail.....	2.179	2.201	2.228	2.262	2.306	2.365
one-tail.....	1.782	1.796	1.812	1.833	1.860	1.895
t-statistic for equality of mean errors:	0.073	-0.166	0.069	0.117	0.033	0.122

TABLE 7
CBO AND OMB FORECASTS OF THE CURRENT SERVICE DEFICIT, FY 1976 FY 1988

fiscal year	OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	-44	76	43	23	10	41	76							
1978		67	50	38	8	24	53	70						
1979			-45	62	-61	38	9	45	76					
1980				49	37	29	-1	38	73	107				
1981					28	40	16	5	25	82	159			
1982						60	55	-28	8	32	85	138		
1983								74	99	92	72	-66		
1984										208	189	-194	-148	142
1985										-195	184	180	177	152
1986											185	224	230	246
1987												-212	206	182
1988													221	175
1989														150
1990														155

fiscal year	percent error of OMB forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	14.29	4.44	53.28	134.66	-168.12	202.14							
1978		0.00	11.78	22.54	72.20	-140.77	171.70	163.29						
1979			0.00	26.64	118.77	-37.08	-111.63	-140.87	139.00					
1980				0.00	35.02	51.34	98.38	134.18	137.21	157.47				
1981					0.00	33.22	78.62	106.34	112.54	-144.04	174.71			
1982						0.00	-25.32	75.14	-95.91	117.27	139.90	162.62		
1983							0.00	10.85	53.17	55.26	66.13	70.10	64.63	
1984								0.00	6.29	1.89	8.53	33.08	-5.52	24.76
1985									0.00	-0.86	15.03	19.76	20.01	2.00
1986										0.00	5.32	4.35	63.30	59.77
1987											0.00	6.84	20.88	3.29
1988												0.00	16.02	3.22
1989													0.00	4.90
1990														0.00

fiscal year	CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	44	74	-51	33	9	13	40							
1978		66	51	38	3	35	78	126						
1979			45	-61	67	-61	-49	39	19					
1980				-49	41	49	-40	10	13	34				
1981					28	-44	21	20	0	0	5			
1982						60	-48	30	18	76	138	209		
1983							74	109	157	-188	208	234	248	
1984								111	194	197	214	231	250	267
1985									-195	190	195	217	248	282
1986										185	214	215	233	249
1987											212	208	181	165
1988												-221	174	169
1989													150	157
1990														155

fiscal year	percent error of CBO forecast													
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1977	0.00	12.96	12.78	32.38	67.51	120.97	-153.44							
1978		0.00	12.44	22.13	89.17	158.72	-205.53	213.92						
1979			0.00	25.51	141.88	2.35	33.71	64.74	90.28					
1980				0.00	46.21	17.79	45.88	91.41	106.40	-118.08				
1981					0.00	26.17	71.59	81.92	-100.00	-100.00	102.36			
1982						0.00	-35.06	-72.88	109.21	141.01	165.00	194.70		
1983							0.00	1.45	19.65	1.46	2.03	6.03	64.89	
1984								0.00	-0.72	6.31	0.80	4.67	66.22	72.15
1985									0.00	2.54	8.15	1.68	64.89	81.82
1986										0.00	0.80	2.58	54.92	60.54
1987											0.00	5.75	20.35	4.38
1988												0.00	15.69	8.96
1989													0.00	1.23
1990														0.00

receipts and outlay forecasts. Second, and closely related, a small percentage error in either receipt or outlay estimates will cause a large percentage change in the residual, especially, as has been the case until recently, if the residual is a relatively small number. Suppose, for example, receipts were forecast to be 999 and outlays 1000; the estimate of the deficit

would be -1. If actual outlays were 1002, (an error of .2 percent), the deficit amount would be 3 (yielding a forecast error of 200 percent). Finally, factors which affect receipts often affect outlays in a way that exacerbates the deficit. An economic downturn, for example, reduces revenues and increases government outlays.

In looking at Table 8, the comparison

TABLE 8
SUMMARY OF DEFICIT FORECAST ERRORS

Office of Management and Budget							Congressional Budget Office							
	D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)		D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)	
forecast year	1976	14.29	4.44	-53.28	-134.66	-168.12	-202.14	1976	12.96	12.78	-32.38	-67.51	-120.97	153.44
	1977	11.78	-22.54	-72.20	-140.77	-171.70	-163.29	1977	12.44	-22.13	89.17	-158.72	-205.53	-213.92
	1978	26.64	118.77	37.08	-111.63	-140.87	139.00	1978	25.51	141.88	2.35	33.71	64.74	-90.28
	1979	35.02	-51.34	-98.38	-134.18	137.21	-157.47	1979	46.21	-17.79	-45.88	-91.41	-106.40	118.08
	1980	33.22	78.62	-104.34	-112.54	144.04	-174.71	1980	-26.17	-71.59	81.92	-100.00	-100.00	-102.36
	1981	-25.32	-75.14	95.91	-117.27	-139.90	162.62	1981	-35.06	-72.88	109.21	-141.01	-165.00	-194.70
	1982	10.85	-53.17	-55.26	-66.13	70.10	-64.63	1982	-1.45	-19.65	1.46	2.03	6.03	64.89
	1983	6.29	1.89	-8.53	-33.08	-5.52	24.76	1983	0.72	6.31	0.80	4.67	66.22	72.15
	1984	-0.86	15.03	-19.76	20.01	2.00		1984	2.54	-8.15	-1.68	64.89	81.82	
	1985	5.32	4.35	63.30	59.77			1985	0.80	-2.58	54.92	60.54		
	1986	-6.84	20.88	-3.29				1986	-5.75	20.35	6.38			
	1987	16.02	-3.22					1987	15.69	8.96				
	1988	-4.90						1988	1.23					
number of observations..	13	12	11	10	9	8		number of observations..	13	12	11	10	9	8
mean error.....	2.57	-13.14	44.07	-77.05	-108.83	-136.08		mean error.....	3.71	-2.04	-26.76	-46.43	-67.62	-91.97
variance.....	342.45	2545.79	2305.87	4490.90	3899.02	3158.15		variance.....	395.00	2706.48	2266.84	5547.41	8841.97	10192.2
mean absolute error.....	15.18	37.45	55.57	93.00	108.83	136.08		mean absolute error.....	14.35	33.75	38.74	72.45	101.86	126.23
variance.....	118.56	1315.82	1159.15	1777.51	3899.02	3158.15		variance.....	202.88	1571.35	1481.94	2454.13	3039.62	2716.85
t-statistic, Ho: u = 0..	0.500	0.902	-3.044	-3.636	5.229	-6.849		t-statistic, Ho: u = 0..	0.673	-0.136	-1.864	-1.971	2.157	-2.577
				D(0)	D(+1)	D(+2)	D(+3)	D(+4)	D(+5)					
				critical values for t-statistic (n-1, .95):										
				two tail.....	2.179	2.201	2.228	2.262	2.306	2.365				
				one tail.....	1.782	1.796	1.812	1.833	1.860	1.895				
				t-statistic for equality of mean errors:										
				-0.146	-0.508	-0.809	0.917	1.033	1.010					

of the estimating errors, two things become apparent. First, as expected, the errors for the deficit forecast were much larger than either the receipt or outlay errors. For the current year forecast, the error in the deficit estimate was at least 8.7 times greater than the larger of the receipt or outlay forecast error. Second, the accuracy of the forecast deteriorated rapidly as the forecast period extended and appears to contain a systematic bias. For both CBO and OMB, the hypothesis that the mean errors were equal to zero cannot be accepted in the case of a forecast beyond the budget year for which it was estimated.

This large amount of error is itself due to two factors. First, in the early part of the sample period, deficits were small relative to the overall size of the budget (15.7 percent of receipts in FY 1975 compared to 28.7 percent in FY 1986). Thus, even small errors in the level of receipts or outlays would have been magnified into large errors in the deficit. Second, the large increase in the level of the deficit over the period (from -\$44 billion in FY 1975 to -\$221 billion in FY 1986), particularly the \$122 billion increase between FY 1981 and FY 1983, resulted in very large errors in the longer term deficit forecasts published in earlier budgets.

Regardless of the difficulties in longer term forecasts, the ability of both CBO and OMB to predict the level of the deficit for the current year, measured by the percent error of the forecast, has improved. Following substantial mis-estimates before FY 1982, the amount of error in the deficit forecast declined sharply, though it remained much larger than receipt and outlay estimates.³⁶ This decline occurred despite the large increase in the size of the deficit in FY 1982 and beyond.

While it is encouraging that the government's deficit forecast has improved, it is not clear that reliance on this estimate will yield the best results for the budget process. G-R-H requires a reduction in planned spending if the deficit forecast exceeds the legislated target by more than \$10 billion. Unfortunately, given even a 10 percent average absolute percent error for the current year deficit

forecast, the deficit must be \$100 billion or less for the \$10 billion range of error allowed for in G-R-H to approximate the range of uncertainty found in past estimates.

IV. Summary

Since the mid-1970s, there has been an increased reliance on the government's ability to produce accurate economic, budget, and tax policy forecasts. In recent years this has become most apparent in the passage of the G-R-H Deficit Control Act and in the "revenue-neutral" groundrules adopted for the consideration of the Tax Reform Act of 1986. Overall, the evidence suggests that the government performs well as a forecaster of aggregate economic activity, particularly in the short run, the period most critical in the making of policy decisions. No evidence of a systematic bias in forecasting was found in any of the budget variables examined for the current year or for the year of the budget submission.

Receipt and outlay forecasts, which rely on a more disaggregated forecast consistent with GNP projections, performed very well over the period of study. Receipt forecasts published by CBO and OMB for the current year averaged less than .1 percent error in absolute value, with the average for outlay forecasts less than .3 percent. Receipt forecast errors rose more quickly than outlay errors as the horizon of the forecast lengthened, primarily due to the many changes made in the tax code since 1980.

The receipts forecasts also suggest that, on the whole, estimates made of the revenue consequences of proposed tax law changes accurately anticipated the realized effects. Errors in receipt forecasts declined sharply after the existence of the new law was incorporated into the assumptions.

Finally, in examining deficit projections, the historical pattern of errors is quite large and shows a significant under-prediction bias beginning two years from the time of the budget submission. As with receipt estimates, however, much of the error during this period was due to

changes in the deficit resulting from tax law changes. The apparent difficulty of obtaining accurate estimates of the deficit, and the inherent amount of variance in the forecast, suggest that the deficit forecast may be an inappropriate variable upon which to predicate fiscal policy.

ENDNOTES

**The views expressed in this paper are those of the author, and do not necessarily represent the views of the U.S. Department of the Treasury. Comments from Howard "Skip" Nester, Janet Holtzblatt, Tom Neubig, Marty Sullivan, Pat Driessen, Doug Norwood and an anonymous referee are appreciated. Particular thanks is owed David Weiner for discussions and comments. All errors are my own.

¹P.L. 99-177.

²As quoted in Executive Office of the President, Office of Management and Budget, *Special Analyses, Budget of the United States Government, Fiscal Year 1988*, Special Analysis A, p. A-1.

³For a detailed explanation see Special Analysis A.

⁴For FY 1988 the relevant CBO publications are *The Economic and Budget Outlook: Fiscal Years 1988 1992*, January 1987; *Reducing the Deficit: Spending and Revenue Options*, January 1987; *An Analysis of the President's Budgetary Proposals for Fiscal Year 1988*, February 1987.

⁵On September 29, 1987, President Reagan signed "The Balanced Budget and Emergency Deficit Reaffirmation Act of 1987," (H.J. Res.324) which amended G-R-H in a number of ways. Among the changes included in the legislation was a revised timetable of deficit reductions which moved the year for achieving a balanced budget from FY 1991 to FY 1993. The specific targets, as amended, are \$171.9 billion in FY 1986, -\$144.0 billion in FY 1987, \$144.0 billion in FY 1988, -\$136 billion in FY 1989, -\$100 billion in FY 1990, -\$64 billion in FY 1991, \$28 billion in FY 1992, and \$0 in FY 1993. See U.S. Senate, Committee on the Budget, "Gramm-Rudman-Hollings and the Congressional Budget Process: An Explanation," S. Prt 99 119, December 1985, p. 3, and Conference Report (H.Rept 100 313) on House Joint Resolution 324.

⁶See, for example, Rauch, [1987]

⁷The act requires the Congress, in preparation of a budget resolution, to agree on a set of underlying economic assumption, set up a budget timetable, and created the CBO.

⁸Penner [1982], p. 98.

⁹The six other forecasts included in his sample were those of Joseph Livingston, the New York Forecasters Club, the ASA/NBER survey, the research Seminar in Quantitative Economics of the University of Michigan, Wharton Econometrics, and the mean end-of-year forecasts of a separate group of seven mostly private forecasts. The number of forecasts compared ranged from four to six in the samples including the CEA. See Zarnowitz [1986], Table 1 and notes

¹⁰Ibid, page 5.

¹¹Ibid, page 8.

¹²Kamlet, et al. [1987], page 369.

¹³Ibid, page 375

¹⁴Penner [1982], page 103.

¹⁵Reischauer [1983], page 41.

¹⁶Budget supplement, page 3a-8.

¹⁷Boskin [1982], page 128.

¹⁸See CBO, Feb. 1981. The Treasury's Office of Tax Analysis (OTA) is responsible for producing the Administration's estimates of tax receipts and estimating the effects of proposed and enacted tax legislation.

¹⁹Ibid, page 17.

²⁰*An Analysis of Congressional Budget Estimates for Fiscal Years 1980 1982* [1984].

²¹Ibid, p. 32.

²²The alternative measure of receipts is proposed law, but it would be a less consistent target since it assumes all of the President's budget proposals are adopted to the exclusion of all others. The potential change in receipts levels due to proposals have varied from +1.22% to 190% for the fiscal year in which the budget is transmitted, and from +3.50% to 690% for the budget year submission.

²³If the direction of change from proposals is random, the mean error of the forecast will not be affected, but the variance will be larger.

²⁴Actuals for all items but GNP are available in time for the January release. Final GNP data is usually not published until March. For early years, CBO reported high and low-growth paths for "current policy": the average of these two series was taken as the baseline case

²⁵The 1976 transition quarter has been omitted from the analysis.

²⁶The test statistic we use throughout for the one and two-tailed test is:

$$Z = (X - u_0) / (\sigma / \sqrt{n}),$$

where X is the mean error, $u_0 = 0$ (the value of X in the null hypothesis), σ is the standard deviation of the population, and n is the number of observations. The variance used is the population variance of the sample. Since we are restricting our analysis to the post-1974 period, we are encompassing the entire population. For the test of the equality of two means, we assume that $\sigma_1^2 = \sigma_2^2 = \sigma^2$, yielding the test statistic:

$$t = (X_1 - X_2) / \sqrt{(1/n + 1/m)\sigma^2},$$

where n and m are the size of the populations of X_1 and X_2 . See Morris and Rolph [1981], page 146.

²⁷The probabilities were drawn from Beyer [1971]. For the GNP(+4) vintage OMB and CBO both show one of eight errors to be positive. The probability of this occurring in a random draw is .0312.

²⁸Monthly receipt and outlay data are published in the *Monthly Treasury Statement*, released approximately four weeks after the end of each month.

²⁹*General Explanation of the Economic Recovery Tax Act of 1981*, prepared by the staff of the Joint Committee on Taxation, page 391.

³⁰Budget supplement, p. 4 5.

³¹See Nester [1987] for a listing.

³²CBO and OTA both use measures of the effects of recently enacted legislation in their receipts estimat-

ing process, although to different degrees; see Nester [1987]. Enacted legislation tables are updated and published each year as a part of the President's budget submission.

³³Penner [1982], pages 96–97.

³⁴In some cases, the deficit reported by CBO did not equal the value of receipts minus outlays due to assumed fiscal policy responses. See CBO, *Five-Year Budget Projections: Fiscal Years 1981–1985*, p. 12.

³⁵Let $D = R - O$. $E(D) = E(R - O) = E(R) - E(O)$, and $\text{var}(D) = \text{var}(R) + \text{var}(O) - 2\text{cov}(R, O)$. See the textbook by Freund [1971], chapter 6.

³⁶An OLS regression of the absolute percent error of the current year deficit forecast on a constant and a time trend yields (standard errors in parentheses):

for OMB: $y = 26.22 - 1.58t$
(5.85) (0.74)

for CBO: $y = 27.45 - 1.93t$
(7.85) (0.99)

All coefficients are significant at at least the 90% level.

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